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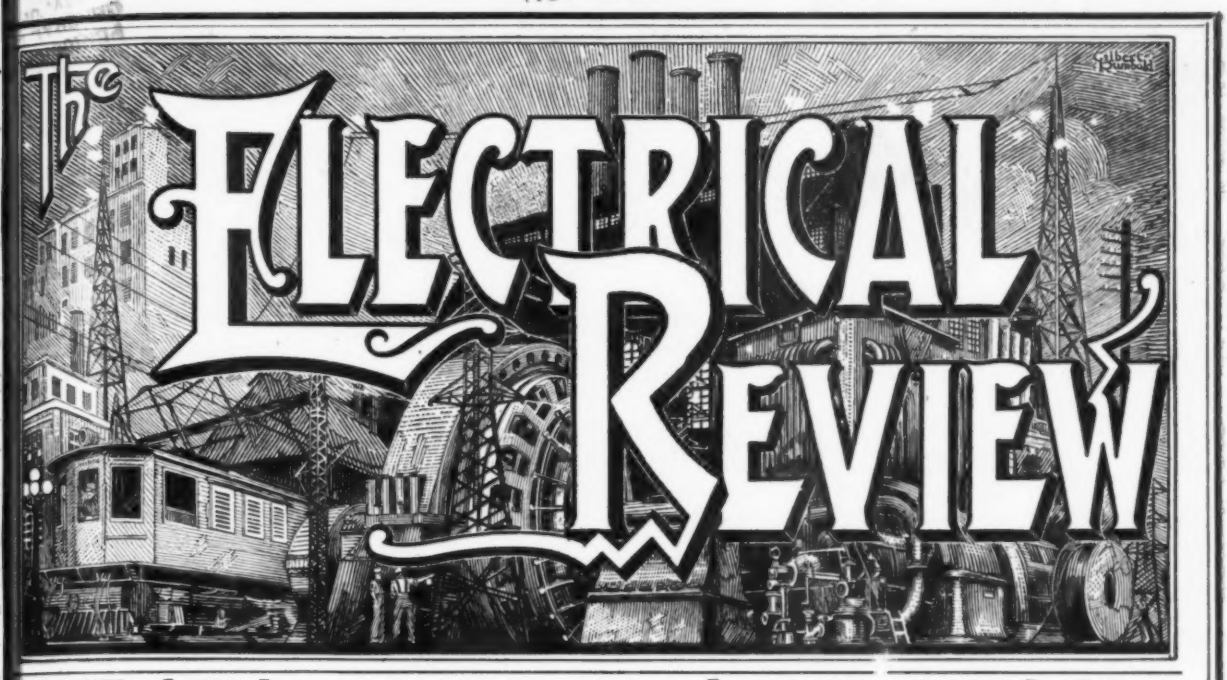

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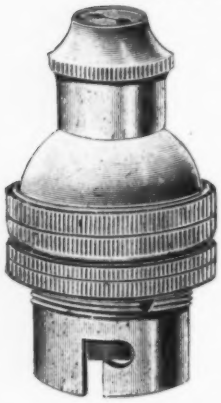

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ELECTRICAL REVIEW.

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IMPERIAL COMMUNICATIONS.

SINCE the Postmaster-General made his disheartening statement before the Imperial Economic Conference a few weeks ago the Dominions have given expression to their disgust at the shilly-shallying of the British Government, as represented by the Post Office, over the question of direct radio-telegraphic communications. It will be remembered that at the Imperial Conference of 1921 the decision was arrived at to establish communication with the farthest points of the Empire by means of the scheme of relay stations put forward by the Imperial Wireless Telegraphy Committee in the previous year—a scheme which was foredoomed to failure owing to the determination of the Post Office to avoid the use of the Marconi patents. Having repudiated the contract of 1912 with the Marconi company, the Department apparently conceived a strong aversion for its victim—a phenomenon strictly in accordance with "human nature," but somewhat unexpected in the case of a Department of State—and would have no relations with it.

Last year, however, the British Government decided to abandon the relay scheme, and to erect a station capable of communicating directly with India, South Africa, and Australia. The adoption of the principle of direct communication necessarily involved the co-operation of the owners of the master patents; the Dominion Governments, having no quarrel with the Marconi interests, and being assured of corresponding action on the part of the British Government, immediately took steps towards carrying out their parts of the new scheme, both Australia and South Africa entering into agreements with the local Marconi companies for the erection of suitable stations for long-distance communication.

In March last the Government announced that the Post Office monopoly of the oversea wireless service would be abandoned, and that licences would be issued to a company or companies to erect Home stations for direct communication with the Dominions. Now, at last, everybody thought, something was going to be done!

Not a bit of it. The Post Office would not yield its privilege without a struggle. The traffic must be shared with the Marconi company; and the process of arriving at "a satisfactory division of the services," said the Postmaster-General to the Economic Conference, had not been completed. Deadlock reigns again, and the Post Office clings tenaciously to its claims, despite the indignation of those who wish to see this country at least on equal terms with other countries. But for the action, and inaction, of the Post Office in the past, we should have possessed to-day a long lead over the rest of the world in wireless telegraphy; now we can never hope to secure it.

The right course for the Post Office to adopt, in the best interests of the nation and of the Empire, is to follow the common-sense example of the Dominions and entrust the service entirely to the hands of competent private enterprise. Then we shall be assured of an efficient service with the least further loss of time, and we shall be spared the burden of financial loss such as has already been experienced in connection with the existing Post Office radio stations at Home and in Egypt.

At a time when intimate communication between all parts of the Empire, but especially between the Home Country and the Dominions, is imperatively necessary, it is indeed deplorable that an obstructive policy should be tolerated in a State Department. We have a million and a half—probably more—of workers without employment. For the revival of export trade to the Dominions,

to which we look in great part for a remedy for this lamentable condition, cheap and speedy communication is a vital need. Yet the British Post Office haggles and procrastinates, with the result that out of some thirty long-distance stations in existence, we have only two in this country. Can nothing be done to clear the obstacles from the path to progress and prosperity, so that the long-delayed revival of industry may be facilitated?

Orders Going Abegging.

As the result of Mr. Patrick's letter last week, which we commented on under the above heading, a batch of letters has been received from firms which are desirous of considering the proposition. This is very satisfactory, and we hope it will result in the manufacture of the motors in England. Whilst one communication came from one of the largest concerns in this country, most of the inquiries emanate from smaller firms, and one of the latter points out that a large concern cannot undertake special work of this description unless a large and general market can be guaranteed; the smaller firms are in a better position to deal with such specialised work. This is, of course, perfectly true, and our correspondent may have put his finger on the solution of the problem. We have forwarded all the inquiries to Mr. Patrick.

Electric Traction for Russian Railways.

The question of the substitution of electric for steam traction on the railways of Russia has been engaging the attention of the National Commissiariat for the Railways and of other State departments. Since 1920, when it was decided to proceed with a scheme for the electrification of the railways, the conditions have undergone a material change, and with this development an alteration is now proposed in connection with the original general project. At the end of September the question reached the stage of consideration of a full assembly of the State Planning Commission, when reports were received from the transport and energy sections, and it was acknowledged to be necessary to deal first with the replacement of steam traction in districts in which generating stations already exist, with particular reference to the districts of Moscow, Petrograd, the Caucasus, the Ural, and the basin of the Donetz. As a result of the deliberations, the Railway Commissiariat was commissioned to prepare for the consideration of the State Planning Commission an estimate of the sums which would be required to carry out a technical and economic examination and prepare a preliminary scheme for the introduction of electric traction on the railways in the districts mentioned, and in particular to submit an estimate of the amounts which would be needed in the Budget in the new financial year for the conversion of the Southern Moscow suburban lines and parts of the Caucasus. Adopting this as a practical programme, the Planning Commission decided that this action did not absolve the Railway Commissiariat from working out a scheme for the electrification of the main lines in the country as was decreed by the assembly of the Soviets in 1920.

Electrical Equipment in Foundries.

The foundry offers a fine field for the electrical engineer. The electromagnet is now much used in foundries for scrap sorting and moving the pig iron from one part of the yard to another, but not as common is the electric core oven. There is often a great deal of waste associated with core drying. When it is possible to heat the core stove with the waste gases from furnaces this is probably the most economical way, but it is not always possible. Cores are usually dried in the night-time when the furnaces are not operating. Coke, oil, and gas are used for the heating of ovens. Coke is wasteful, and the electric oven is, without doubt, the most easily controlled. This is an important factor, especially with the development of quick-drying oils and cores when the drying temperature is of great importance. The factors that should determine which method of heating is adopted are the saving in rejections, the improvement in the quality of the cores, and therefore in the castings, the cost of power, the cost of attendance, and the cost of upkeep.

In America electricity has made great headway in the foundry, and at a meeting of the iron and steel electrical engineers in Buffalo in September, to which prominence was given by the foundry Press of America, experts compared the relative costs of electric heating with other methods, and emphasised the importance of the thermostat as a guardian over the electric oven. Even more interesting at the same meeting were the discussions on foundry cores and electric moulding machines. Electric runways and overhead cranes have for very sufficient reasons become popular in this country, but it is surprising how many medium-sized and small foundries are still faithful to the old-fashioned hand-operated jib crane and also the hand-operated overhead crane. The foundry crane has to stand considerable abuse, and there is always much dust that has to be taken into consideration when ordering equipment. Electric cranes are gradually replacing hand cranes, however. One paper read at the conference already mentioned urged that all foundry cranes should be fitted with foot brakes and the hoists with either load brakes or dynamic braking.

Conveying systems in British foundries are very much behind the times. In the average American foundry, cranes or their trolleys are used for dragging cores and moulding boxes round the floors. The electric trolley is used in some foundries in this country, but not in many. Large foundries are content to have the haulage done by labourers, and this will not be changed until electrical engineers impress foundry owners with the economy that results from electric traction. Foundry floors—especially in jobbing foundries—are not usually level, nor are pathways always clearly defined, but there is no reason why they should not be. Handling charges in many foundries are ridiculously exorbitant.

Press Propaganda.

It is interesting to read, in the *Gas World*, that Mr. J. Jamieson, of Edinburgh, in his presidential address to the Scottish Gas Salesmen's Circle, complains of "the preference which is given to electricity in the Press." This strikes us as a novel view of the matter; hitherto the complaints have emanated from the electrical side. Apart from the perennial suggestions that fires are "due to the fusing of an electric wire," on frequent occasions we have noticed eulogistic articles extolling the virtues of gas, often surrounded by a collection of advertisements of appliances for use with gas, whilst electricity has rarely enjoyed the like publicity. That may have been the fault of the electrical trades, and we are glad to think that, largely owing to the activities of E.D.A., a great improvement has been effected—so great as to attract the serious attention of our competitors.

Mr. Jamieson points out that the peak load on gas undertakings is now in many cases higher in the day time than at night, and he therefore advocates preferential rates for lighting purposes in order to preserve the night load—precisely the opposite policy to that of the electricity supply undertakings. It is recognised by numerous speakers in discussions on gas supply that electricity is winning the lighting field, and proposals are made to defer the victory by various means, such as offering maintenance of gas fittings, &c., though Mr. Jamieson thinks this will not, of itself, prevent the ultimate adoption of electricity for lighting. The gas industry is also discussing sliding-scale tariffs by which the price is reduced as the consumption increases, and is beginning to differentiate between standing and running charges.

FURTHER NOTES ON ELECTROLYTIC RECTIFIERS.

By MORTIMER A. CODD, F.Ph.S.

Following a number of experiments on the rectifying properties of aluminium cells,* attempts were next made to produce a commercial arrangement suitable for running for long periods without attention.

The first cells produced consisted of the usual sheet-iron tank acting as the anode and enclosing the aluminium cathodes immersed in the electrolyte. The mid-point system of connections was used in every case (fig. 4, Vol. 92, page 325).

It was found that after such a cell had run for some time, say four days, its rectifying properties began to fail, and the cell would heat up unduly. On changing the solution and fitting new aluminium electrodes, the cell would start off again quite satisfactorily, but eventually begin to fail again after about three days, while a further charge would bring the satisfactory life of run down to about two days, and so on.

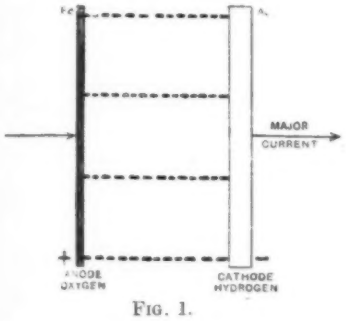


Fig. 1.

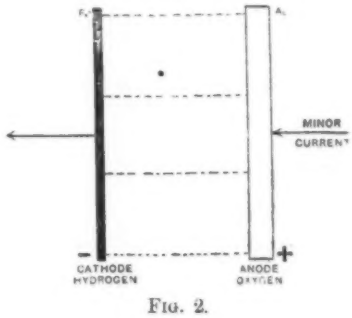


Fig. 2.

It was further found that on running the cell for protracted periods (and in some cases after quite short runs), the sheet-iron walls of the tank would become perforated in a number of places.

Since everything had been changed, except the tank itself, it appeared that the falling-off in output must be due to some change in the surface of the tank itself. Analysis of the electrolyte showed only the presence of small quantities of iron in solution. Tanks lined with sheet lead were next tried, but though these did not perforate so easily, the fatigue of the cell was much increased. The surface of the lead became corroded and covered with a brown skin of lead oxide, although examination of the electrolyte showed only the very faintest traces of lead in solution.

The next attempt to avoid the perforation of the tank was to use glass or earthenware containers, and to arrange the lead or iron plates, sandwiched with the aluminium cathodes, as in the conventional accumulator cell. The effect of this was to reduce the effective running life of the cell from days to hours.

Having reached this stage in the experiment, the writer began to consider whether too great attention had not been paid by experimenters in the past to the aluminium electrode, whereas the failure might be due to some defect of the anode. Clearly the size of the containing anode had something to do with the fatigue of the cell, even if that fatigue arose as a secondary cause from the aluminium cathode.

Since the life of the cell seems to be proportional to the size of anode surface exposed, it would seem that the surface itself fatigues and eventually ceases to conduct, because old electrodes and electrolyte put in a new tank will work satisfactorily for a normal run. Evidently the surface of the anode suffers some change similar to polarisation in a primary cell.

In the accompanying fig. 1 we have the current flowing in the major direction with the evolution of oxygen and hydrogen at the anode and cathode respectively. This completes one wave in the positive direction, or one half cycle. Most of this gas passes off, but the oxygen may account to some extent for the rusted surface of the iron anode.

Next we have the negative wave, as in fig. 2. Here the conditions are reversed, and although theoretically no current should flow, there is, in fact, a small flow due to valve slip in the inverse or minor direction. It is this current apparently that forms the non-conducting film of insoluble oxide on the aluminium electrode, and a clinging film of hydrogen gas on the iron plate, polarising it sooner or later, depending upon the area exposed and the current density.

If polarisation of the iron anode does take place as surmised, the addition of a depolariser to the electrolyte should improve matters, and in fact does so. Permanganate of potash, bichromate of potash, and bichromate of soda were successfully used with different solutions, also manganese dioxide packed round the anode in porous pots. These solutions gave much improved results even when added to an already fatigued cell, but still better results were obtained by using carbon plates, especially carbon plates coated with platinum black. It may be mentioned here that these plates must be of "electrolytic" carbon (carbon for electrolytic purposes made from sawn blocks of gas retort *coke*); ordinary prepared carbons disintegrate into sludge in a few hours.

The last cell constructed having carbon plates was run over eight days, and success seemed well in sight. The cell was now made up in commercial form, but proved little better than its iron tank predecessor in practice.

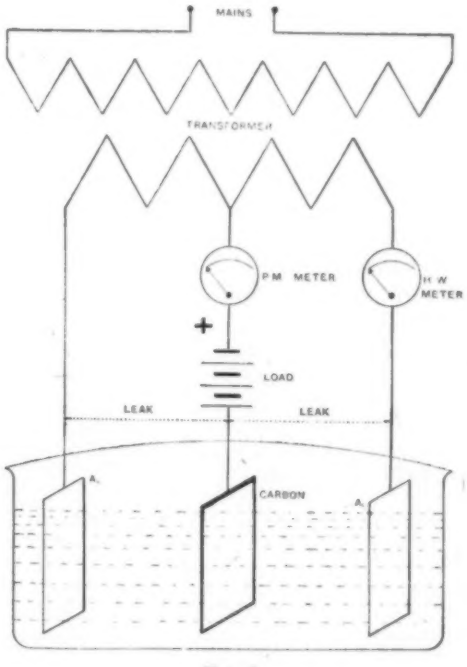


Fig. 3.

To explain this result, comparison was made between the successful experimental cell and its commercial form, but little difference was apparent. Numerous experiments were then entered upon—varying the solutions, the strength of electrolyte, the current density,

* Elec. Rev., March 2nd, 1923; Vol. 92, p. 324.

and the size of the electrodes—all to no purpose. Yet obviously there was some difference between the cells for one to give such superior results.

The only visible difference appeared to be that, while in the commercial cell the electrodes were suspended clear from an ebonite lid, in the more flimsy experimental cell the electrodes had been kept apart by wooden separators at their lower ends, the whole being held together by a rubber band.

It seemed unreasonable to suppose that these wooden blocks could account for the superior running of the experimental cell, but seeing that they were the only difference between the two cells, they were withdrawn from the experimental and placed in the commercial form of cell, with the result that the latter cell then proved entirely satisfactory.

Clearly the wooden blocks were accountable for the absence of fatigue in the cell, and this could only be due to one of two factors:—

1. Either the wood itself had some catalytic action on the electrolyte, or

2. It was acting as a "leak" between the electrodes.

The substitution of ebonite blocks for the wooden ones immediately resulted in the cell fatiguing as before. A new cell was set up, without any blocks or separators whatever, and a small leak was arranged external to the tank as is fig. 3. This artificial external leak proved quite satisfactory.

I am unable entirely to explain the behaviour of this catalytic leak, but suggest that under the conditions in which the minor current is dying away (fig. 2) the film of hydroxide has already formed, and the aluminium plate forms one surface of a condenser of considerable capacity. The presence of the "leak" enables this charge to escape before the current begins to grow in the major direction.

Exactly why this should be advantageous is not clear, but whereas in the original iron-tank cell dense quantities of aluminium hydroxide were precipitated in white clay-like form, with the carbon electrode and catalytic leak the precipitate was comparatively small; also the aluminium plates remained fairly clean, whereas they would be covered with a hard scaly deposit in the older form, particularly if the electrolyte became overheated.

Having reached this satisfactory conclusion, the question arose whether these conditions were dependent on the leak entirely, or whether the depolarising effect of the carbons also contributed to the success of the experiment.

A cell was accordingly tried with iron and aluminium electrodes, having the leak in position but using no depolariser; but although it did not fatigue so readily as a plain iron-aluminium cell, it did not give such good results as the similar cell using a carbon anode.

From these experiments it may, I think, be concluded that for the satisfactory operation of electrolytic rectifying cells two conditions are desirable, the first being some method of preventing the anode from polarising, and the second, the arrangement of a leak between the two electrodes.

When testing these cells, the connections shown in fig. 3 were used; the p.m. ammeter being connected in the main central circuit read rectified current, and the hot-wire meter in one leg read the current in the outer circuit. As long as the current remained rectified in the leg circuits, both meters read approximately the same, but as rectification ceased, the h.w. meter would gradually increase its reading over that shown by the p.m. instrument.

As an example, when freshly started, the p.m. instrument would read, say, 5 amperes, and the h.w. instrument 4.5, which would rise in the course of the run to 6 or 7, at which point the cell began to heat up and the test was accounted as terminated.

Under certain circumstances, and when using a transformer with a falling characteristic, the h.w. meter would read as low as 3 amperes when 5 amps. was indicated by the p.m. instrument. The catalytic leak was a non-inductive resistance of the order of 500 ohms over each leg, but this resistance need not be very critical within reasonable limits.

NOTES ON SWITCHGEAR SPECIFICATIONS.

By AN ESTIMATOR.

The experience gained from many years' compulsory study of specifications has convinced me that the art and mystery of switchgear is hidden from many who may be called upon to send out inquiries for this class of apparatus. Therefore I offer a few suggestions as to the amount of information to be given in an inquiry, in the hope that among the chaff a grain of wisdom may be found.

In the first place, it is well to state the voltage of the system; a clue may sometimes be obtained from the voltmeter readings called for, but a definite statement promotes a feeling of harmony all round. Similarly, information as to the type of system, a.c. or d.c., number of wires or phases, frequency, &c., lends a certain tone to what would otherwise be an ordinary specification. The cost of potential transformers and integrating instruments, among other items, is affected by the frequency of the system, and equipment which would suffice for a shunt-wound d.c. generator operating alone on a two-wire system may not be adequate for a compound-wound generator operating in parallel with others on a three-wire system.

When dealing with a.c., particularly, the question of breaking capacity arises; a little consideration will convince even a country bell-hanger that the short-circuit power to be expected from an isolated 50-kVA alternator is less than the short circuit which would be obtained by dropping a crowbar across the busbars at Hell Gate (a very large power station in the country where all figures are written as so much x 10^n to save space). By reason of this peculiar phenomenon it is necessary to install oil circuit-breakers of much more robust construction at Hell Gate than would be needed for a factory generating its own power from a tired oil-engine set. It is not expected that one who has read so far would be able to calculate the possible short circuit in a given locality, but if the capacity of the generating plant is stated, or the capacity of the power station and size and length of the feeders supplying the switchboard, together with particulars of any transformers intervening, the estimator will be able to work it out; that is why he is sometimes called a switchgear engineer—in any case it is all given in the B.E.S. Specification for Oil Switches.

Should the purchaser have a preference for any particular type of switchgear, the type should be stated, or else a description of the class of duty, and a brief *résumé* of the education of the proposed attendants is of considerable assistance. It is usual to afford Chinese labour every opportunity of securing a cheap and easy death by electrocution, whereas skilled power-station attendants in this country are protected by a humane Home Office, and by our insular prejudice against taking unnecessary risks.

The loose use of expressions such as indicating, integrating, and recording is to be deprecated. If the writer of the specification feels any doubt in his mind he

uld go into the matter thoroughly and describe an dicating wattmeter as an instrument which indicates, the movement of a pointer over a graduated scale, e power flowing in a circuit at any instant. If a ttmeter merely is specified, there will probably be pplied a box of gear wheels which counts up the watts they flash by, multiplies them by the period for which y flow, divides by 1,000, and puts up the result as its on a face like that of a gas meter. (If the word gas" is not liked, substitute "taxi.")

By all means specify the instruments required; if it desired to control an a.c. feeder, an oil circuit-eaker and ammeter may suffice, but if this is not speci-d the conscientious estimator may include a watthour-ter with maximum-demand attachment, power-factor dicator, an ammeter in each phase, illuminating lamp, d an eight-day non-magnetic clock in handsome wrought-iron scroll work. It will then be necessary for the purchaser to read through all the tenders to compare the prices.

Should the equipment include a battery and booster, every known fact should be stated; whether the booster is automatic or non-automatic, whether it regulates charge only, or charge and discharge, &c. There is more in a battery installation than is commonly realised, and nothing short of a complete and correct diagram of connections will give all the information required.

Finally, a word to those who always ask for prices by return: in some cases the article required may be catalogued, but if it is a switchboard, remember that no two switchboards of more than one panel have ever been known to be the same, and other inquiries await attention. One day a price may really be required by return—remember the boy who cried "Wolf!"

THE CYNWYD, NORTH WALES, HYDRO-ELECTRIC STATION.

A 106-kW Gilkes Installation.

HYDRO-ELECTRIC installation of considerable interest as inaugurated last summer at Corwen, in North ales. The scheme was originally intended to be a ivate one to meet the needs of Colonel Vaughan Wynn, "Rug," but was subsequently extended to serve the all country town of Corwen and various farms and ouses on Col. Wynn's estate, through which the over-ad mains pass.

The electricity generated is three-phase at 3,300 volts, d is obtained from two water-driven turbo-alternators, ing transmitted by means of overhead conductors. he whole of the work was designed and carried out by essrs. Gilbert Gilkes & Co., Ltd., of Kendal.

The water supply is obtained from the Trystion ream, and the power house is tuated about half a mile above the illage of Cynwyd. About 500 yards ove the power house the stream sses from an open basin-like valley to a steep, rocky gorge, at which int, fig. 1, a concrete dam, 25 ft. gh at the centre and 50 ft. across the top, was erected by Col. ynn's own men, thereby obtaining torage of some 1,100,000 cu. ft. of ter; 17 ft. 6 in. from the top of e dam an intake chamber is aced, containing an 18-in. valve d the usual straining plates, to ich is connected the 1,600-ft. long peline, which consists of 18-in. veted steel pipes. The first portion the pipeline is supported on asonry piers, built on to ledges ng the side of the gorge. The e then passes through a rock cut-g and down a steep declivity to e power house. The total gross fall m the top water level in the dam to the power-house or is 210 ft., and the net working head at full load is out 200 ft.

There are two turbines of the Turgo impulse type, the rger one developing 140 h.p. at 500 r.p.m., and the aller 25 h.p. at 1,000 r.p.m., fig. 2. The reason for e two sizes is that in normal water times the larger can be run fairly efficiently at all loads, but in times extreme drought, which it is anticipated will gener-y be in summer when electric lighting and heating ds are at a minimum, the smaller set should prove re efficient in water consumption.

Messrs. Gilkes's system of govening consists of drum-e pendulums mounted on one end of the turbine shaft and coupled directly to deflectors, without the aid of servo-motors; no flywheels are fitted, but economisers are used which, following up the action of the governors, adjust the quantity of water used to the load as it varies, without in any way affecting the delicate accuracy of the governors.

The two turbines are coupled directly by means of flexible couplings to Brush three-phase alternators of 112.5 kVA (90 kW at 0.8 p.f.) and 20 kVA (16 kW at 0.8 p.f.) respectively. The larger alternator generates at 3,300 volts and the smaller at 220 volts in conjunction with a step-up transformer to 3,300 volts.

The switchboard, supplied by Messrs. Crompton and Co., Ltd., as sub-contractors to the Brush Electrical

FIG. 1.—DAM AND RESERVOIR.

Engineering Co., Ltd., is arranged simply as two independent generator panels, each with oil-switch control, and trips on two phases. No synchronising gear is fitted at present, the intention being that each generator shall be alternative to the other, but arrangements are made so that the step-up transformer, referred to above, can also be used to supply low-pressure current for local lighting and power purposes.

The lighting of the power house is done with 100-volt d.c. provided by the exciter of either generator, by means of a change-over switch.

Transmission is effected through No. 7 s.w.g., hard-drawn, bare copper conductors arranged in triangular formation, the top insulator being carried on a tubular

galvanised bracket and the lower two on timber cross-arms with wrought-iron stays. For the first 4,000 yards the whole transmission is through a single set of mains to a junction point, at which one branch of 1,400 yards supplies Col. Wynn's house, "Rug," and another branch of 2,000 yards the town of Corwen.

At the junction point link switches and h.p. fuses, by the Electric Control Co., Ltd., protect the two branches independently, the switches and fuses being mounted on a suitable angle-iron framework fixed at the top of an "H" pole erection.

The two lines terminate in a 100-kVA and a 25-kVA step-down transformers at "Rug" and Corwen respectively, the l.p. transmission pressure being 380 volts between phases for power purposes and 220 volts between the line and earthed neutral for heating and lighting circuits. The l.p. distribution at "Rug" was carried out by Col. Wynn's estate engineers, and includes immersion heaters for domestic hot-water and radiator supplies and extensive cooking apparatus, in addition

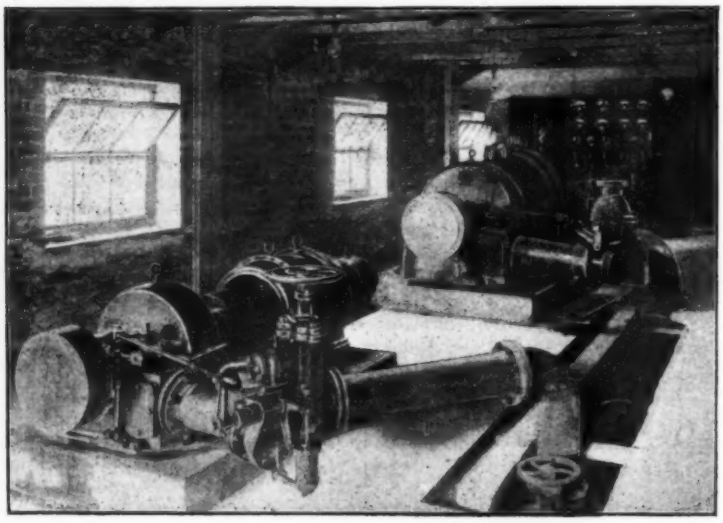


Fig. 2.—Hydro-Electric Power House.

to lights in the house and saw-mill motors, &c., in the adjoining estate workshops.

At Corwen the l.p. supply at the same voltages as at "Rug" is connected, first, to a suitable bulk-supply metering panel, and thence to the town supply distribution board. The town distribution is through bare conductors carried on steel poles in the more central streets and on wooden poles in the outlying districts. About 100 houses are already connected, and the street lighting is by means of iron brackets fixed to the poles with independent central-switch control at the transformer house.

It was decided not to install lightning arresters on the system, the lead in the paper-insulated armoured cables at the terminals of the lines being considered to have sufficient condenser effect to deal with lightning surges.

The h.p. mains cross three times over main roads, twice over the railway, and over numerous footpaths and by-ways. In the case of the main Holyhead Road and G.P.O. trunk telegraph system, the mains are carried underground in paper-insulated, lead-covered, armoured, and served cable. In the case of the other main roads, the overhead conductors are protected by cradle guards supported on independent wood poles, the G.P.O. wires being laid underground at each point of crossing. The same system applies to the railway crossings, but in these cases the telegraph wires are not interfered with.

For footpath and occupation road crossings the system has been adopted of double insulator supports and a short length of hanging wire clamped to the main conductors, and carried on the duplicate insulator.

The h.p. transmission-line poles were felled locall some being oak, others larch; they were treated wi Solignum. Parts of the line pass over shoulders of t local mountains in very exposed positions where speci staying was necessary.

Very extensive tests of the plant were carried out b the contractors during the week May 7th to 12th, wi a view to obtaining as accurately as possible the wat efficiencies of the generating sets. These tests gave a overall efficiency, including both turbine and electric losses, of 74.3 per cent. at full load.

It may be of interest to relate that in carrying o these tests, one means adopted to measure the speed the water passing through the pipeline was that introducing at the head of the pipes a small quanti of saline solution and noting when it reached the pow house by the reduced electrical resistance of the colum of water between two electrodes fixed into the pipelin at the power house, d.c. at 100 volts being passed b tween these electrodes with a voltmeter in series. Wi plain water flowing in the pipes, t voltage registered was 55, which ro rapidly to 80 when the saline sol tion passed the contacts, falling ba as rapidly to 55 when the solutio had passed.

A signal bell operated from t head of the line indicated t moment the saline solution w introduced, and by means of a st watch it was a simple matter t record the time that elapsed befo the voltmeter pointer reached i peak point, indicating minimu resistance. The period of peak vol age was only a few seconds, where the total time from the introducti of the salt till its arrival at th power house was from eight to fifte minutes, according to the load o the plant.

To obtain a local power absor ing load, three electrodes, ea consisting of about a yard o 37/16 bare stranded cable, su pended vertically about 10 in. apa from a wooden triangle over a deep pool in the stream was found very effective, even to the extent of killing few trout. The triangle could be raised or lowered b means of a cord and pulley to adjust the load.

The installation, which was commenced in August las year, was carried out under extremely onerous condi tions, owing to bad weather and the flooded state of th country over which the mains passed.

The final tests were carried out by Major Crewdson A.M.Inst.C.E., and Mr. W. M. Harris, A.M.I.E.E. (o Gilbert Gilkes & Co., Ltd.), Mr. Taylor (of the Brus Electrical Engineering Co., Ltd.), and Mr. Phillips resident engineer for Col. Wynn. The ceremonia inauguration of the plant took place on May 19th last.

The Manchester Dance.—We have received particulars o the Electrical Engineers' Dance, which is to take place at th Midland Hotel, Manchester, on Friday, December 7th. M C. D. Taite, 196, Deansgate, Manchester, is acting as honorar secretary, and Mr. W. E. Gower, of the same address, h honorary treasurer. Tickets, inclusive of supper (but n wine), are one guinea each. Applications should be made t any member of the general committee whose names follow Messrs. H. Allcock, E. E. Baker, A. G. Barnard, A. Erskine J. H. Farthing, *G. H. Fawcus, V. Ferranti, F. C. Gibbons C. H. Hampson, *J. Harcourt-Williams, J. H. Juhlin, Maj Linton, A. G. Livesay, B. Longbottom, *A. B. Mallinson, Co E. O'Brien, A. E. Du Pasquier, S. L. Pearce, G. Preece, H Richardson, *A. S. Rinder, A. Roberts, J. A. Robertson, T. F Sherwell, G. F. Sills, *B. Thomas, E. Thomas, S. J. Watson *J. H Whitmoyer, A. P. Wood, W. J. H. Wood. (*Members of Executive Committee.)

THE ECONOMICAL LIMITS OF BOILER LOADING.

By CHAS. F. WADE, A.M.I.Mech.E., A.M.I.E.E.

It would be interesting to know upon what basis the number of boilers used to deal with a given steam demand is decided in most cases. So far as the writer's experience goes, the usual system is to work as few boilers as possible as will provide the amount of steam needed, whether the boilers are being forced or otherwise not being taken into consideration.

The usual reason for the mode of procedure suggested is that the increased labour and power costs will more than neutralise the reduction in fuel cost associated with steaming the plant under easy conditions. In the case of small units the cost of labour and power will, of course, represent a larger proportion of the total than is the case with large modern plants. In the former case with the smaller units it may require one attendant for every 20,000 lb. of steam per hour evaporative capacity or even less, while in a large modern plant one man may well be able to deal quite well with 100,000 lb. of steam per hour.

While there is a very definite upper limit of evaporation rate above which the efficiency of a boiler falls away, it does seem to be sufficiently well realised that there is practically no lower limiting figure of the same kind. That is to say, even a banked boiler may be so worked that very little more heat is used than that necessary to make good "radiation" losses, the latter being considerably less in total amount with the boiler under low temperature banked conditions than when steaming at an appreciable rate. The same applies to the losses due to air leakage, this being greatly reduced in total amount owing to the greatly reduced draught pressure employed upon a standing boiler than under normal working conditions.

Generally speaking, the maximum efficiency of a boiler will be most readily obtained from 20 per cent. below to about 20 per cent. above the maker's normal rating, while, under scientific methods of operation, the efficiency can still be maintained well below the lower figure already mentioned.

The factors which will determine the upper limits of economical loading of any given boiler plant will vary with the local conditions obtaining with each individual plant, and are as follows:—

Available draught power.
Draught system.
Labour costs.
Class and quality of fuel used.

The available draught power will, of course, determine the maximum amount of coal which can be burned efficiently in the furnace or the maximum combustion rate obtainable at maximum furnace efficiency. Under conditions of highest furnace efficiency there is a definite proportion of air required to burn the coal so that the greatest possible proportion of the potential heat units are actually generated from the fuel and are neither wasted in heating up excess air nor carried away in unconsumed or partially consumed or decomposed combustable matter. This limit can only be determined by the employment of suitable indicators, such as CO_2 recorders. In this case furnace efficiency must not be confused with boiler efficiency, the latter being the percentage of the heat generated in the furnace which is actually absorbed by the boiler. A furnace may have a high efficiency of heat generation; but this heat is not necessarily absorbed by the boiler to do useful work. Boiler efficiency, as usually termed, is really the combined overall efficiency of two distinct units, *i.e.*, the furnace and the boiler.

If the draught power which is available is only about sufficient to provide enough air to consume an amount of fuel which will give the maximum rated duty, forcing of boilers will not be possible, and losses due to this cause will not be present. Where, however, a good margin of draught is available, it is often the case that the boilers are worked well beyond their economical limit either knowingly with the object of keeping down labour costs or unknowingly owing to the absence of the necessary apparatus to indicate when the critical point has been reached.

The draught system employed will affect the economical limit of output inasmuch that if natural draught is in use, the limit will be reached sooner than when mechanical systems are in operation, for in the former instance the additional draught power will have to be obtained by raising the temperature of the waste products in the chimney, a generally recognised wasteful principle. In the case of mechanical draught, the power required will not only be affected by the increased weight of gases to be handled, but also by the increase in volume due to the higher temperature of the gases handled when the boiler is being worked appreciably above normal rating.

Labour costs will enter very largely into the question when it is required to determine the commercial limits of boiler loading and coupled with this consideration the power costs for stoker, economiser, fan, and other drives will have to be taken into account.

The quality and class of coal used will have a very great effect upon the limit of loading, especially as regards the nature and percentage of ash. A high ash coal which forms heavy clinkers will, if fed at too high a rate, produce so much clinker that it will pile up on the dumping bars and the clinkers will accumulate so rapidly as to get out of hand or else call for almost continuous opening of the access doors in order to ease the clinkers over the dumping bars and through the dumping doors. This will, of course, lead to large quantities of excess air being admitted, accompanied by serious losses of fuel.

Theoretically, there is no limit to the heat-absorbing capacity of a boiler, but the efficiency of absorption will depend upon the arrangement of the heating surfaces and their ratio to the grate area. The heating surface being a fixed quantity, the amount of heat which it absorbs efficiently, *i.e.*, the true boiler efficiency, will, above a certain figure, fall away fairly rapidly, the loss being indicated by the final temperature of the waste gases. The excessively long grates usually fitted to Lancashire boilers, so that a high rate of evaporation is obtained, are very productive of large losses in the chimney; 1,000 deg. F. is not at all an unusual temperature in these cases when the fires are being carefully worked and the brickwork is in good condition.

In order to show the lines upon which correct limits of loading should be determined, presuming that ample draught is available, we will assume that we have an average bituminous coal of 13,732 B.th.u. calorific value at a cost of 25s. per ton delivered into the bunkers. Taking a small plant of 20,000 lb. per hour evaporative capacity per boiler, and labour costs at 1s. 2d. per hour per man, for purposes of illustration, we may assume that the furnaces consume one ton of coal per hour per boiler, although this will be a somewhat low efficiency. Under these conditions one man will be sufficient to look after two boilers so that the cost per hour for the two boilers will be:—

Coal, 2 tons, at 25s.	£2	10	0
Labour	0	1	2
Stoker drive, &c.	0	0	2
	£2	11	4

Assuming, again, that the final temperature of the gases is 400 deg. F., and that there is a percentage of CO_2 in the gases of 12 per cent., the loss in the chim-

ney will be 13 per cent. of the coal used, or, roughly, 6s. 4d. per hour.

If the evaporation is increased by 30 per cent. rather than put another boiler into commission, so that the final temperature of the waste gases is raised to 500 deg. F., the loss in the latter will be increased to approximately 17 per cent. of the fuel used, so that the coal cost will be increased 30 per cent. on account of the increased evaporation, plus 4 per cent. of this total on account of increased chimney loss. What we have, therefore, is:—

Coal	£3	7	7
Labour	0	1	2
Stoker drive, &c., say	0	0	3
	£3	9	3

Brought down to terms of cost of evaporating 10,000 lb. of water, we have, under the first-named conditions, 40,000 lb. for 51s. 4d., or 12s. 10d. per 10,000 lb., and under the second conditions 52,000 lb. for 69s. 3d., or about 13s. 3½d. per 10,000 lb.

The result of putting a third boiler to work, instead of overloading the original two boilers, would, with careful firing, mean that only the labour and power costs would be increased, so that the costs would be as follows:—

Coal	£3	5	0
Labour	0	2	4
Stoker drive, &c.	0	0	3
	£3	7	7

Showing a saving of 1s. 8d. per hour as compared with working two boilers at an overload.

Properly speaking, there should be added to the cost of working the overloaded boilers that of the fuel consumed by the boiler which is banked.

Where large units are in operation, the percentage cost of power and labour to the whole is reduced, while the net losses are increased, so that the reduction on economy by overloading amounts to a proportionately large figure.

Other incidentally increased costs associated with keeping the number of working boilers down to a minimum is the wear and tear of furnace brickwork occasioned not only by the high furnace temperatures involved, but also the accelerated depreciation caused by the more frequent heating up and cooling off.

Probably below the evaporation rate exemplified above, the overloading of the boilers will be a more economical proposition than doing otherwise, as the labour cost involved will not be merely the actual time worked at the boilers, but also a certain addition due to time which has elapsed between the men being at work and their clocking on or off.

This question is one which calls for careful observation and application of the indications afforded by recording pyrometers and CO_2 recorders, as these are the only means whereby the economical limits of loading can be definitely arrived at.

FILLING AN APPOINTMENT.

(From a Correspondent.)

Anyone who has had experience in dealing with replies to advertisements under the heading "Situations Vacant" must have been somewhat appalled by the number of replies received.

The first few arrive on the Saturday after the day of publication, and are followed by a "peak" load on Monday and a smaller "peak" on Tuesday, and so on until after about a week the postman delivers the last straggler.

For the ordinary sort of job from 150 to 200 replies are received, and it is thought that a description of the method of dealing with them in one particular office may be of assistance to those readers who from time to time reply to such advertisements. It is hoped also that it may have some effect in reducing the troubles of the advertiser.

The work of selection usually begins after receipt of the first post on Tuesday. All letters are opened, and any loose testimonials and copies of testimonials are pinned to the letters they belong to, as are any stamped and addressed envelopes which some applicants always send.

All the letters are then read by a responsible member of the staff who is familiar with the requirements of the job, and who has, naturally, a pretty concrete idea of the sort of man who will fit the job.

The majority of applicants are usually unsuitable for one reason or another, *e.g.*:—

1. The applicant is obviously too good for the job.
2. Has not the right experience for the job.
3. Writes an unintelligent letter or fails to give essential particulars.
4. Is too old or too young for the job.

These applications are put on one side as throw-outs.

Another pile is made of applications from those who appear to be "possibles."

As the letters are gone through, a few from men of particular suitability are encountered, and these are marked V.G. and put on a third pile.

The "possibles" are then read through again, and, as a rule, several are transferred to the V.G. pile and some added to the "throw-outs."

Then comes the job of selecting the two or three to be interviewed, and this is usually difficult, the final selection often depending on considerations unconnected with the personal or technical qualifications of the applicant. For instance, men living at a great distance are at a disadvantage, as are those who are already in a job and not free to leave without notice.

In a recent case an analysis of the applications gave the following:—

Thrown out	87.9 per cent.
Possibles	9.2 per cent.
V.G.'s	2.9 per cent.
	100.0 per cent.

The final selection is made as a result of the impression made at the interview, and here again it is often difficult to decide who really is the best man for the job, due consideration being given to such points as the applicant's apparent health, temper, and gift of getting on with other people, the last being by no means the least important.

The "throw-outs" are often the most interesting, apart from the sort of man who writes:—"Having seen your advertisement, will be pleased to give full particulars if you will grant me an interview." Such persons usually write from addresses two or three hundred miles away. If they only realised the number of fully-detailed applications which are always received they would know that such a letter cannot be filed anywhere except in the waste-paper basket.

Then there is the ambitious young man, aged about 20, with an "extensive experience in all classes of electrical work."

As a whole, the applications leave an impression that most of the writers are good, sound people, and while the reader's sympathies are often painfully stirred, there is some compensation in finding that there are so many thoroughly decent people in the world.

The least courtesy to which they are entitled is a notice under the heading "Appointments Filled."

Regulating Parisian Street Traffic.—It is proposed to use electric signals to regulate the traffic in the main thoroughfares of Paris. According to *Modern Transport* the system of electric signals which is to be imposed is modelled upon that which has been used with success in New York, and an experimental installation is shortly to be tried along the Grands Boulevards, where a whole series of signals will be operated from one switchboard.

THE USE OF SINGLE-CORE CABLES ON THREE-PHASE SYSTEMS.

By E. BERRY NIXON.

Station engineers refuse in some cases to consider the use of single-core cables on main e.h.p. connections in the power stations over which they have command. This is no doubt due to the inborn dislike of departing from the old principle of 3-core cable, and the distrust of anything new. The general argument against single-core cables is that they are supposed to be liable to excessive lead sheath losses, which cause pitting of the sheath.

To disprove this theory we examine the causes of sheath losses which are more serious in the case of l.p. cables; there are two, which can be tabulated as:—

(*a*) Sheath circuit eddies whose outward path is along the sheath of one cable, and return path along the sheath of another.

(*b*) Sheath eddies whose outward and return paths lie along the sheath of one cable.

Sheath circuit eddies are eliminated in modern practice, as the lead sheaths are prevented from coming in contact with each other, and as used with ironclad switchgear the glands of one set of cables are insulated from the dividing box, so preventing a return path for the eddies.

Sheath eddies cannot altogether be eliminated, but, as we have eliminated the most serious cause of sheath loss, and in the case of l.p. cables the sheath eddy loss is only about 4 per cent. of the copper loss, its heating effect can be considered negligible.

Long runs are not a detriment to the use of single-core cables, as the losses are proportional to the length of cable. With h.p. cables we have a better case than with l.p. ones, as the radial thickness of the insulation is usually larger than the core diameter; this curtails the number of lines which reach the sheath as compared with l.p. cable, and as the sheath eddy losses in the l.p. cables are only 4 per cent. of the copper loss, the loss will be negligible in h.p. cables.

On the assumptions that the cables are correctly spaced, *i.e.*, half the diameter as maximum spacing between sheaths, with either three-phase or flat racks, and that their sheaths are prevented from coming in contact with each other by spacing or taping over the lead, it is considered that single-core cables are perfectly safe.

In conclusion, it is hoped that this very brief article will go a little way to dispel the doubts regarding single-core cables.

New Engineering Society.—At a meeting held at Norwich last week, attended by more than sixty engineers, it was resolved to form the Norwich Engineering Society. The resolution was proposed by Mr. A. E. Collins (the city engineer), seconded by Mr. Thomas Glover (engineer and manager of the Norwich Gas Works), and supported by Mr. F. M. Long (the City electrical engineer), who said that the formation of the Society would be an important development because Norwich was becoming more and more an engineering centre. Many new firms had sprung up in the last few years and the tendency was for them to increase. Mr. W. H. Scott (of Messrs. Laurence, Scott & Co., Ltd.) also spoke in support of the motion. The meeting elected the following officials: President, Mr. A. E. Collins; vice-presidents, Mr. F. M. Long and Mr. W. H. Scott; hon. treasurer, Mr. C. J. Jewell (of the Norwich Tramways Co.); hon. secretary, Mr. R. A. Lower (of the Corporation Electricity Works).

Science Exhibition.—The Scientific Novelties Exhibition held at King's College during the Christmas holidays, 1922-23, aroused so much interest, and was the means of raising so substantial a sum in aid of the hospitals of London, that it has been decided to repeat the experiment this year. The exhibition will be open from December 29th, to January 29th (inclusive), between the hours of 2 and 9 p.m. Demonstrations and short lectures, with experimental or lantern illustrations, will be given, and promises of such lectures have already been received from Prof. Cheshire, Prof. Winifred Cullis, Prof. Eddington, Sir Richard Gregory, Prof. Morley Davies, Prof. Smithells, and other eminent scientists. The proceeds will be given to King Edward's Hospital Fund for London.—*The Times.*

MODERN SHOP-WINDOW ILLUMINATION.

"Gecoray" Lighting Equipment.

We recently had the pleasure of witnessing an instructive demonstration of modern methods of shop window illumination at Magnet House, which was arranged by the General Electric Co., Ltd., primarily for the benefit of members of the British Association of Display Men.

After Mr. J. Y. Fletcher, a director of the G.E.C., had welcomed the members and guests, an informative paper on the value of shop window illumination was read by Mr. E. L. Randall, of the G.E.C. Illuminating Engineering Department and, following a short discussion, various window lighting effects produced by means of ordinary, coloured, and artificial "daylight" illumination were convincingly demonstrated, and a series of show cases containing exhibits so arranged as to emphasise the value of various factors, such as shadows, coloured light, &c., were examined.

Mr. E. L. Randall pointed out that a well lighted shop window is one of the most vital factors in business getting, and that co-operation between the merchant and the artist has resulted in window display reaching a high standard. For nearly six months in the year, however, the windows are entirely dependent upon artificial illumination for 30 per cent., at least, of their effective day. A perfect window illumination does not merely consist of a sufficiency of glareless light; it must be of such a nature that the artist is given a fresh means of expression, which will not merely attract, but actually arrest the passer-by. Such illumination, he claimed, is obtainable by the use of silvered-glass reflectors with various colour screens, floodlights, and spotlights, which comprise the "Gecoray" window lighting equipment. The reflectors, which are made in four standard sizes, the largest of which is 8¼ in. high and 9¾ in. wide, can be used in any type of window, and are guaranteed not to tarnish, check, or peel, provided that they are used with the lamps specified, and care is taken that the lamps do not touch the reflectors.

The crystal glass reflectors are moulded with accurate contours and fluted to disuse the light rays. The mirror surface is double plated with pure silver, and heavily plated with pure copper electro-deposited over the silver, the final covering being green enamel stoved on at a high temperature. The colour films are flexible, being held in place between two metal rings with retaining wires stretched across each, the whole being attached to the reflector by means of two springs; the colour films are easily changeable.

It is a well-established fact that the number of people who will stop to examine a window, and the number of people who enter a shop to make purchases, will increase in proportion as the intensity of light in the window is increased. Within fairly wide limits, the increased profit per hour obtained when the window lighting is improved is twenty times the amount of money spent per hour on the increased amount of electricity used—an extremely profitable investment. These figures are obtained with the use of ordinary clear-glass lamps, but when colour is added to the intensity of window illumination, the possibilities become infinite; beautiful effects can thus be obtained, which it is possible to reproduce automatically by the installation of a suitable flashing device.

Mr. Randall laid great stress upon the importance of continuing shop windows illuminated after closing time. It is an encouraging fact that many of the electricity supply authorities are now prepared to grant specially reduced rates for window light after business hours, and the use of a time switch to extinguish the lamps renders the extra expenditure involved by the employment of a caretaker or attendant unnecessary.

As a proof of the value of late lighting, Mr. Randall quoted some figures, the result of his own observation in various London shopping centres, which showed that at a conservative estimate, 250 persons per hour will stop to examine a window, the cost of illuminating which is 2½d. per hour. Two hundred and fifty people reached in this convincing manner at a cost of 2½d. is a proposition which no trader, however small, can afford to overlook.

An account of a demonstration that strongly emphasised the value of coloured light would be incomplete without some reference to the gasfilled "White Osram" lamp, which incidentally is also made in many colours. For positions where it is desired to expose the lamp itself, the glare difficulty can be overcome by the use of these lamps. They are standard lamps which, after having been made and tested, have their bulbs subjected to a process of spraying (the material sprayed on consisting of clay and certain other ingredients) which produces an effect similar to that of a standard opal glass bulb. Over the latter, however, the "White Osram" possess the following outstanding advantages: Although the filament is completely hidden, the absorption factor of the sprayed glass is lower than that of opal glass, and the lamps are, therefore, more efficient; they are uniform in colour and density; keep their colour, and consequently last longer; can be washed with soap and water as frequently as may be desired, without injury; and cost much less than opal lamps, being only 10 per cent. more than standard clear-glass gasfilled lamps.

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

Fifteenth Annual Report.

ONE of the best records of electrical progress is the report published annually by the Hydro-Electric Power Commission of Ontario. In the fifteenth report, covering the year 1922,* this character is accentuated, for embodied in it is the record of the inauguration of the first portions of the Queenston plant.

The amount of space at our disposal permits us to give only a very inadequate review of this voluminous publication, for, apart from recording the proceedings of the Commission itself, the report contains exhaustive data regarding the operations of the two hundred odd "hydro" municipalities during the year.

Probably the most interesting section is that which summarises the operation of the fourteen "systems" into which the province is divided. The year was marked by a great increase in load, an improvement which was general in most of the systems. The extra demand added materially to the difficulties of operation, and in many cases great vigilance had to be exercised to prevent the overloading of the systems. The manner in which demand follows closely upon the installation of new plant was exemplified by the case of the first Queenston set, which within a very short time of its starting-up was working at its full rating, necessitating the expeditious completion of further plant. A table is printed in the report showing that the demand on other systems than Niagara closely approached or exceeded the normal generating capacity. The incalculable advantages of water power have been further emphasised by the prevailing coal shortage, and it is said that to have used coal for the generation of the same amount of power would have taxed the resources of the province and its people beyond endurance.

Dealing with the systems *seriatim*, the report first reviews the operation of the Niagara system. The most notable occurrence here was the placing in operation, in January, 1922, of the first Queenston set. The plant has been referred to fairly fully by us on previous occasions. The system experienced severe storms during the year, but the lightning protection proved adequate and little damage or loss of power was occasioned. Great activity was shown in the extension of transformer stations, and the first 110,000-V outdoor-type station was placed in service in October, 1922, near Hamilton. The huge task of maintaining the transmission lines in good order was successfully carried on during the year, and new circuits were erected. The undertaking of the Ontario Power Co. was not troubled with any serious interference with operation by ice, but in April, 1922, a bad accident occurred. A heavy short-circuit on a generator was followed by the speeding-up of its water-wheel, which went out of control and caused the bursting of the generator rotor. The set was totally wrecked, another was seriously damaged, and four others had to be shut down temporarily. The failure is attributed to defective castings in the rotor runs. The machine had not received a "runaway" test before it was put into service or it would have failed then. The first Queenston set was ready just in time to take over the load from the wrecked station. A generating capacity of 25,000 kW was lost by this accident, as well as 40,000 kW temporarily. The purchase of the Toronto Power Co. and allied interests was completed on November 1st, 1922, and full control was taken by the Commission on that date. The plant had, however, been operated in trust for the Commission since December, 1920.

The Combined Northern Systems record a general increase in load. The Severn and Wasdells systems rendered assistance to the Eugenia system during their low-load periods, permitting the Eugenia storage basin to be filled against times of heavy load. Power was purchased from the Orillia Water, Light & Power Commission for the same purpose. The difficulty in meeting the demand upon the Severn system was accentuated in April, 1922, by the breaking of the defective shaft of a 2,300-h.p. turbine. With the aid of the other systems of the group it was possible to supply full power to the Severn municipalities.

The Muskoka System also reports that the generating capacity was taxed to its utmost. The breaking of a shaft caused two short periods of restricted power, and some trouble was experienced, due to the burning-out of armature coils.

The raising of the pressure from 25,400 to 44,000 V on the St. Lawrence System necessitated a great many changes in the transmission system.

The Rideau, Thunder Bay, and Ottawa systems had an increasing load and operation was satisfactory.

The most noteworthy event during the year in the Central Ontario and Trent system was the commencement of working of the Ranney Falls station. The first set, of 4,500-kVA capacity, was started in August, 1922, and a month later the second set of similar size was put into service. The transmission system worked satisfactorily, chiefly on account of the re-insulation, which was carried out in 1919 and 1920. The Peterboro municipality provided an additional line, by which the surplus energy generated by the Peterboro Hydraulic Power Co. could be utilised in the system. The system suffered considerably from water shortage, and special studies were made to ascertain what form of flow regulation could be advantageously employed.

The generating station of the Nipissing system was operated very closely to its maximum capacity as regarded both generating equipment and water supply. In August, 1922, the Braie Lake storage dam was maliciously blown up with dynamite by persons unknown. This, in conjunction with a natural water shortage, rendered operation still more difficult. A fire, due to lightning, occurred in the North Bay auxiliary steam plant in April. A 150-kW generator was badly burned and a 300-kW machine was damaged by water. The former was returned to the makers for repair, but it was possible to repair the other machine on site.

In the section dealing with constructional work during the period reported upon the principal matters which receive attention are the Queenston and Ranney Falls developments. The information is very detailed, but the main interest lies in the fact that three of the 45,000-kVA sets were put into commission during the year. The second one broke down in April owing to the separation of a ventilating fan from the rotor. This damaged the armature windings, rendering the machine *hors de combat* for over a month. The starting-up of the third set was delayed by the failure of the armature-winding bracing during a short-circuit test. Since 1922 two other generators have been added to the plant. The Ranney Falls installation consists of two vertical-shaft generating sets of 4,500 kVA each, working at 120 r.p.m., and delivering their 3-phase output at 6,600 V, 60 cycles. The structural work was completed in a very speedy manner. The steel-work erection commenced on December 1st, 1921, and was finished by January 21st, 1922. The stonework was completed in just over four months. The erection of the generators was started in April and the first set was placed in service in August and the second in the following month. The power from this plant is stepped up to 44,000 V by two transformers and fed into the Healey Falls-Sidney transmission line. Provision has also been made to tie in the plant with the Campbellford-Stirling line.

In the Nipissing system a commencement was made upon the erection of a small plant at Bingham Castle. This is to consist of two 450-kW generators.

There was considerable activity upon the transmission side during 1922. Many new transformer stations were erected and others had their capacity increased. The largest piece of work carried out in transmission lines was the completion of the tie line from the Queenston plant to the 110,000-V trunk lines between Niagara Falls and Dundas. This line is now carrying over 200,000 h.p. A new trunk line from Queenston to the new 110,000-V distributing station at East Hamilton was also erected, and preliminaries were settled with regard to a 110,000-V trunk line from Queenston to the St. Thomas district. Studies for future developments have led to the suggestion that the transmission lines in the vicinity of Niagara Falls and Queenston should follow the same routes as those used for the transportation of goods and for other vehicular traffic. The report contains a sketch illustrating a tentative scheme of this nature. The towers form part of the loading platforms of the tramway system. It is proposed to space them at distances of from 500 to 700 ft.

About two-thirds of the report is devoted to the financial results of the year, and a vast amount of detailed information not amenable to adequate treatment in small space. Among the tables which appear in this section are statistics of street lighting showing population, number and sizes of lamps, and cost; cost of power to municipalities and power rates to consumers; lighting rates; and comparisons of the results of every undertaking from 1912 to 1922. An appendix gives exhaustive details of transmission lines. It shows that at the end of 1922 the Commission's transmission lines had a total length of 3,138 miles; this figure included 515 miles of 110,000-V steel-tower line in the Niagara system.

The first part of the section dealing with the electric railways within the Commission's jurisdiction is devoted to the refutation of charges which have been made against the Commission in this respect. It is denied that the construction of 3,500 miles of lines is contemplated; this figure merely represents the mileage put before the Commission by various municipalities for approval. Only 326 miles of line have actually been approved. Contrary to a widely-held opinion, it is maintained that the opening up of new districts by the Commission's electric railways will provide traffic for the national railways and not take it from them. Railway projects are not "forced" on municipalities but are the outcome of requests made by the municipalities for better traffic facilities. During 1922 the Essex District Railways were provided with 17 one-man cars of the double-door type to replace a number of two-men cars. For special heavy passenger service four double-truck safety cars were ordered. A new rotary sub-

*Toronto: Clarkson W. James (King's Printer).

ation in connection with the Amherstburg line was put into peration during the year. A great deal of new construction nd reconstruction was carried out. As 1922 was a year of ehabilitation and improvement the financial results are not a rue index of the state of affairs; there was a net deficit of 4,365. Similar conditions prevailed on the Guelph Radial ystem, which incurred a net deficit of $22,911, but at the ame time improved its position as regards earning capacity in uture years.

A large amount of work was carried out by the Electrical nspection Department and the laboratories. The latter were hiefly concerned with high-pressure equipment, but among ther things they produced a system of "wired wireless" for se upon the transmission lines.

LEGAL.

Lane v. Indicators, Ltd.

An action concerning an invention known as Earth and Short-Circuit Detector Switch was brought before Mr. Justice Bailhache in the King's Bench Division on October 30th. Plaintiff was Mr. R. H. Lane, of Wimbledon Park, who sued defendants, of 11, Southampton Row, London, claiming damages for alleged breach of contract to take over an invention.

Mr. Werninck, for the plaintiff, said that in October, 1920, it was arranged between the plaintiff and a Mr. Waller, of the defendant firm, that the defendants should take over and manufacture the apparatus which his client had invented. Plaintiff was to have a certain share of the profits and was to be appointed manager of a special department which the defendant company intended to open in order to deal with the article.

Defendants denied that there was ever a concluded contract between the parties.

Plaintiff, in evidence supporting his claim, said that prior to August, 1920, he had taken out a provisional protection for his invention, No. 24,683, dated October 9th, 1919. On August 9th, 1920, he saw Mr. Waller, of the defendant firm, and discussed the matter of taking it over. Certain details were arranged then, and later other matters were agreed. After seeing Mr. Waller again on October 7th, he thought the whole matter was settled. Witness was to receive 20 per cent. of the English and 10 per cent. on the foreign rights. After waiting for some time, witness offered to sell his interest in the patent to the defendants for £200.

In cross-examination, plaintiff said that Mr. Waller must have thought something of the invention, because he considered he would be able to pay plaintiff £300 a year for his services in the new department. Mr. Waller was practically the first person he showed the invention to. He had not offered it to the Westinghouse people at all.

Mr. Waller gave evidence denying that he had ever made any agreement with the plaintiff. The latter was continuously pressing him for a guarantee to which the defendants could not possible agree. The matter was always adjourned, because they could not get any definite suggestion as to the assignment of the patent. In testing the market the defendants found there was very little chance of bringing the article out. In witness's opinion the invention had no market value unless a lot of money was spent upon it.

His Lordship, in giving judgment, said he thought it would be a mistake to estimate the value of the invention at more than the money which the defendants had already paid in connection with the matter. He did not think there was a concluded agreement between the parties. But the plaintiff had undoubtedly presented to the defendants a joint share in a product which they both thought at one time might be a business success. In connection with the patent, the defendants had borne an expense of something like £40, and he had no means of knowing whether there was or was not a sufficient payment for their joint share. He thought the proper thing to do under the circumstances was to give judgment for the defendants and order that there should be no costs. Judgment accordingly.

O'Driscoll v. Marconi's Wireless Telegraph Co., Ltd.

In the King's Bench Division, on Tuesday, November 6th, Mr. Justice Bailhache heard an action brought by Mr. Florence O'Driscoll, an engineer, of Bickenhall Mansions, W., against defendant company, claiming damages for alleged breach of a contract of employment.

Sir Henry Maddocks, K.C., Mr. Comyns Carr, and Mr. Percy Handcock, appeared for the plaintiff. Defendants were represented by Mr. Stuart Bevan, K.C., and Mr. Somerville.

Sir Henry Maddocks, explained that the action was brought to recover damages upon a contract entered into by Mr. O'Driscoll and Mr. Godfrey Isaacs, on behalf of the defendant company. In effect the agreement was one of employment by the Marconi Co. upon certain terms and the defence set up was that Mr. O'Driscoll was not employed by the defendants but by an Argentine company, of which the London company was the parent company. The issue was, therefore, whether the defendants had employed the plaintiff and the real question turned upon a number of interviews which took place between plaintiff and Mr. Godfrey Isaacs.

Dealing with the history of the matter, Sir Henry said that in 1905 the London company formed another company in the Argentine, with the object of purchasing and exploiting the patents relating to the Marconi system. The parent company in London retained control of the Argentine company, which was to establish a high-power station in the Argentine for the purpose of transmitting messages to Europe. Accordingly the Argentine company obtained a concession on August 31st, 1906. In October, 1912, Mr. O'Driscoll was appointed a director of the Argentine company. At that time the plaintiff held an appointment with *The Times* at Buenos Ayres. In 1913 Mr. O'Driscoll visited England and was appointed manager for *The Times* in South America. One of the terms of that appointment was that he should resign his appointment as a director of the Argentine Wireless Co. Plaintiff communicated this to Mr. Godfrey Isaacs, who urged him to reconsider the matter. Ultimately Mr. Isaacs invited him to name his own terms for acting as the defendants' representative in South America and relinquishing his appointment with *The Times*. Mr. O'Driscoll said he would want a salary of £1,500 a year and the appointment as supervising engineer at 1,000 paper dollars a month in connection with the erection of the proposed high-power station. He also required a call on 10,000 fully-paid shares in the Argentine company. Mr. Godfrey Isaacs agreed to accept those terms and plaintiff accordingly resigned his position with *The Times*. It was upon that agreement that the present action was based. On Mr. Isaacs' instructions the plaintiff remained in London during 1913 and 1914 arranging the specifications, plans, and contracts relating to the proposed high-power station. When the war broke out plaintiff, on the instructions of Mr. Godfrey Isaacs, wired to the Argentine people, informing them that they were to suspend all operations connected with the high-power station. Matters then came to a head with regard to Mr. O'Driscoll's salary. Mr. Isaacs had told him that he would receive his salary from the Argentine company, who, becoming alarmed at the prospect of a long war, wrote to the defendant company, saying that they could not go on paying plaintiff's money indefinitely. Mr. Isaacs told the plaintiff not to worry about his money, and from that time onward he received payment from the defendant company. In September, 1916, the plaintiff went to Brazil on behalf of the defendant company, with powers of attorney in order to discuss certain matters with regard to the Brazilian station. He remained in Brazil until July, 1918. On his arrival in England he saw Mr. Godfrey Isaacs, and after reporting the situation in South America, took his instructions to go on as before, preparing the details of the station. In January, 1920, Mr. Godfrey Isaacs told the plaintiff to hold himself in readiness to go to America again after an agreement had been signed by which the rights of the defendants in the Argentine were to be sold to an American company. Mr. Isaacs appeared to have repented of that agreement and wanted the plaintiff to go over to South America as the representative of the defendant company to see if he could put an end to the agreement with the American company. In November, 1920, the plaintiff went to Buenos Ayres and found that the Germans had obtained a concession for the erection of a high-power station, as well as the French and Spaniards. Plaintiff reported those facts to Mr. Isaacs, who then concluded that the best thing he could do would be to join hands with the Germans and other people in their high-power station enterprise. That was pointed out to the plaintiff, who was asked to persuade the Argentine shareholders that the new arrangement would benefit them ultimately. Mr. O'Driscoll then saw that his position as supervising engineer would go and that he would lose his call on the shares of the Argentine company, which would probably be wound up. He pressed Mr. Isaacs to give him some definite agreement and many interviews took place. At one stage an agreement was almost reached, the defendant company offering the plaintiff a salary of £3,500 for three years. Mr. O'Driscoll, however, stipulated for six years and the arrangement fell through. In those circumstances the plaintiff brought his action.

On the suggestion of his Lordship counsel consulted together, but the parties were unable to come to terms and the evidence of plaintiff was then taken.

Dale v. Igranic Electric Co., Ltd.

Mr. Justice Swift, in the King's Bench Division on November 1st, heard an action in which Mr. Arthur Badger Dale, who resides at "Happy Days," West Mersea, Essex, claimed £105 in respect of an alleged breach of agreement by defendant company in connection with the hiring of stall space at an exhibition of electrical products.

Mr. Cyril Atkinson, K.C., appearing for plaintiff, said that he was claiming under an agreement made between him and the defendants by which they were to take certain space at an electrical exhibition held last year at the Central Hall, Westminster, and they undertook to fill the space with exhibits. The rent for the space was to be ten guineas, of which five guineas was paid down. One of the terms of

the agreement was that if defendants failed to fill the space they should pay £100 damages, and plaintiff claimed that defendants, having failed to carry out the terms of the agreement, they were liable for the £100 in addition to the outstanding five guineas for rent. The defence set up was that the space available was not in accordance with the plan and description given in the prospectus and not reasonably fit for the purpose for which it was required. Then the question of authority was raised, but that part of the defence had been abandoned. On the question of registration of the business name, application was made for relief, but when it came before Mr. Justice Rowlatt he adjourned it until the trial of the action.

Mr. J. B. Matthews, K.C., for the defendants, said that plaintiff was never in a position to give the space contracted for, and he was going to rely upon the want of registration.

After Counsel's speeches and the hearing of evidence, his Lordship, in giving judgment, said there was nothing, in his opinion, to prevent an individual getting up an exhibition, and in this case Mr. Dale was minded to run the exhibition for his own profit, and he was taking the whole responsibility of endeavouring to get together a number of people interested in wireless matters and induce them to take space and exhibit their goods from September 2nd to 8th, 1922. There was nothing wrong in that. In his prospectus he spoke of the organisers of the exhibition and convention as having had 40 years' experience, and that was not true so far as he was concerned ,although it might be true as regarded Dale, Reynolds & Co. The statements of the prospectus were therefore not wholly accurate. Then he said that all communications must be sent to the organising director, and he further complicated matters by putting after his name the name Dale, Reynolds & Co. That fact gave the defendants an opportunity of saying that the prospectus was inaccurate. That, however, his lordship thought, would not deceive any one. There was a form of contract for the hiring of space, and by that the request was to be made to "Mr. A. B. Dale, organising director (Dale, Reynolds & Co.)" He thought the request was intended by Mr. Dale to be a request made to him personally, and any one making the request would realise that he was making it to A. B. Dale. He did not think the defendants were misled, and thought they intended to contract with Mr. Dale. The defendants said they found that the leading people in the trade were not exhibiting, and consequently they desired to withdraw. As an excuse for so doing they alleged that the space was unsuitable owing to the proximity of a glass case, but Mr. Matthews did not regard that point as worth argument, the plaintiff having offered to remove the case, and he (plaintiff) was entitled to the unpaid five guineas for rent. Then there was claimed against defendants £100, damages for failure to carry out the contract to occupy the space. The defendants ought to have known the conditions of the hiring, and if they did not read them it was their own fault. Having signed the contract, they were bound by it and were liable for damages. In regard to the non-registration of the business name, his lordship held that under the circumstances registration was not necessary, as there was nothing in any of the documents to indicate that Mr. Dale was carrying on the business under the name of the Wireless Radio Exhibition and Convention. The Business Names Act was never intended to apply to such cases as this. Under all the circumstances, he came to the conclusion that Mr. Dale had made out his case, and there would be judgment for him for £105 5s., with costs, being £100 damage and 5 guineas outstanding rent.

Judgment was entered accordingly.

County of London Electric Supply Co., Ltd., v. Reading.

In the Mayor's and City of London Court, on October 30th, before Judge Shewell Cooper, the plaintiff company sued Mr. D. J. Reading, motor engineer, of Peckham, for £10 13s. 11d., meter rental and electricity supplied.—Mr. Harry Strouts, plaintiffs' solicitor, said they abandoned £4 of the claim and only claimed £6 13s. 11d. for electric current supplied for the March-June quarter and up to July 27th, when the supply was disconnected for non-payment of the account. Defendant wanted credit for the £3 deposited by the previous consumer. Of course plaintiffs could not give that.—Mr. F. S. Wheeler, plaintiffs' chief collector, said the accounts had to be challenged within seven days of the receipt of the account. So far as he knew defendant had never challenged the account.—Defendant said there had been mistakes in the readings by the plaintiff company of his meter, as plaintiffs' letter showed.—Mr. Strouts said that the letter was a mistake, and an allowance had been made for the charge for the meter.—Defendant added that he took over his business lock, stock and barrel. All receipts were handed to him and therefore he thought he was entitled to the deposit of £3, which they kept because his predecessor owed the plaintiff company £1 8s.—Mr. Strouts said if the defendant would get his predecessor's authority to say that defendant might have the deposit they would give it to the defendant.—Defendant said he did not know where he was. Plaintiffs had admitted that it was impossible for him to have used the electric light charged for.—Plaintiffs' representative said that the defendant was dealing with the darkest quarter.—Judge Shewell Cooper said he must find for the plaintiffs for £6 13s. 11d., with costs.

REVIEWS.

Workshop Routine. By W. J. Hiscox. Pp. x+159; figs. 2. London: Chapman & Hall. Price 9s. 6d. net.

This volume is one of the "D.U." (directly useful) series initiated by the late W. J. Lineham, and edited by Mr. J. L. Bale, and is the work of an author who, as our own pages have testified, is *au fait* with the subject on which he writes. It is divided into two parts, the first dealing with the principles involved and the second with their application to practice by way of "standing instructions," the latter constituting four-fifths of the book. The author points out that "nothing dislocates routine in the workshop so much as the unrestrained activities of the intelligent man"; hence he emphasises the necessity of instructions so detailed and precise that the man who thinks for himself will not be able to misinterpret them.

The importance of conducting manufacturing operations systematically and scientifically is thoroughly appreciated nowadays; but system can be carried to extremes. The author lays stress on the necessity of enlisting the co-operation of the business manager and the works manager with the organiser, in order that every possible circumstance may be taken into consideration before the scheme of organisation is set in operation; and he shows that verbal explanations of a system are insufficient—hence the use of "standing instructions," which can be altered when necessary, but must be kept constantly in view.

In the second part of the book, Mr. Hiscox treats in detail of the nature and form of standing instructions, the mode of distribution, and the numerous purposes for which they must be drawn up, with explanations of the system of organisation and examples of actual instructions. The book should be of great value to those concerned with this subject, particularly the smaller manufacturer who is confronted with keen competition and feels the necessity of reorganisation to cope with it.

Mining Electrician's Handbook. By Lionel Fokes. Pp. viii+414; figs. 230. Wigan: Thomas Wall & Sons, Ltd. Price 10s. 6d.

This book is what it professes to be, a handbook for colliery engineers and electricians engaged in supervising colliery electrical plant.

The author has had considerable experience as a colliery electrician, and therefore, as he himself says, "can claim first-hand knowledge of mining conditions."

The book deals solely with the "electrical" portion of the plant, and in this respect is quite different from other works treating of colliery electrical plant; instead of dealing with coal-cutting machines, pumping and haulage plant, &c., the author confines himself to electrical apparatus. We quite agree with this aspect as, we are told in the preface, "it is immaterial whether a motor, for instance, is driving a haulage gear, a pump, or a coal-cutter; the principles involved, and the general rules to follow in securing satisfactory operation, remain the same."

The work contains some 400 pages, divided into twelve chapters, the first four dealing with elementary electricity, electric bells, and dynamo and motor construction; chapter 5 deals with electric lighting and instruments; chapter 6, alternating-current circuits; chapter 7, induction motors, &c.; chapter 8 deals with transformers; chapter 9, switchboard equipment; chapter 10, cables, &c.; chapter 11, drying apparatus, drying motors, testing, earthing, &c.; chapter 12, mining switchgear, underground lighting, miners' electric lamp maintenance, &c.

There are also some useful formulæ, &c., and the Home Office general regulations and memorandum relating to the use of electricty in mines. The book is well printed, but some of the illustrations, especially the half-tone prints, are very poor, and these with advantage could be much improved. Otherwise it is an excellent book, a book which has long been wanted, and it will prove exceedingly useful and instructive not only to colliery electricians, but to mine managers, students, and all those interested in the use of mining electrical plant.

New Electrical Institute at Derby.—On October 26th, at Derby, the official opening of the new Electric Institute took place in the presence of a large gathering of members of the Electricity Committee and the staff and employés of the Corporation Electricity Department. Ald. W. G. Wilkins, chairman of the Electricity Committee, formally handed over the Institute to the staff. Mr. T. P. Wilmshurst, borough electrical engineer, gratefully accepted the gift on behalf of the staff and the employés. He dwelt upon the human element in the operation of the power station and distribution system. Mr. J. C. Mann, on behalf of the employés, expressed their gratitude to the Electricity Committee for the excellent rooms and furnishings provided. A short game of billiards was played and a whist drive followed.

BUSINESS NOTES.

Bankruptcy Proceedings.—P. S. Kennedy (Martin & Co.), electrical engineer, 102, High Street, Stoke Newington, N.—Receiving order made October 30th on debtor's own petition. First meeting November 14th; public examination February 8th, both at Carey Street, W.C.

G. W. Taylor (G. W. Taylor & Co.), electrical engineer, 2, South View, London Road, Fletton, Hunts.—Receiving order made October 30th on debtor's own petition.

L. Backhouse, C. Thornton, and S. Evans (Arc Electrical Co.), electrical and wireless suppliers, Palatine Buildings, Victoria Street, Manchester.—First meeting November 14th at the Official Receiver's offices, Byrom Street, Manchester. Public examination December 7th at the Court House, Manchester.

J. E. Elliott and J. M. Elliott (J. E. Elliott & Co.), electrical engineers, 12, Broad Street, Oxford.—Public examination (transferred from Oxford) December 19th at Carey Street, W.C.

A. J. Barlow (Barlow Bros.), electrical and general engineer, 9, Brunswick Place, City Road, N.1.—First dividend of 5s. in the £ payable at the Trustee's offices, 14, Old Jewry Chambers, E.C.

Francis Bertram Thorpe, 1a, West Laithe Gate, Doncaster, electrical engineer.—The receiving order in this matter was made on October 12th, on debtor's own petition. The statement of affairs showed ranking liabilities of £841, and there was a deficiency of £49. Debtor attributed his failure to small profits, losses on contracts, depreciation of stock in trade, and shortage of capital.

Charles Edgar Payne, 39, Mortimer Street, London, W.—A sitting of the London Bankruptcy Court was held on November 6th, before Mr. Registrar Mellor, for the public examination of this debtor, who returns liabilities £140, and assets "cash at bankers, 9s." In the course of his evidence, the debtor stated that in October, 1922, he obtained employment as representative of the Standard Electric Sign Co., Ltd., and held that post until the company went into compulsory liquidation in December, 1922. Whilst so employed he advanced about £800 to the managing director, who was now bankrupt in the High Court; the money was used for the purpose of the company, but he looked to the managing director for repayment, and to the loss of that money, combined with his own personal extravagance, he attributed his failure and insolvency.

Private Arrangement.—L. Spreadborough, 14, Frith Street, Soho, and 539, High Road, Leytonstone, electrician and wireless dealer.

In response to a circular letter issued by Messrs. Carter and Carter, solicitors, 4, Gray's Inn Square, W.C., a meeting of the creditors of the above was held on November 2nd, at the Holborn Hall, Gray's Inn Road, London, W.C., when Mr. Carter, the solicitor, acting on behalf of the debtor, stated that so far as could be ascertained the liabilities amounted to about £360, while there were practically no assets. There were contracts on hand; one at Harrow which, when completed, would show a profit of £100, but £40 would have to be expended on it. There were also two other contracts in the meat market. The debtor had no household furniture. He was instructed to offer a composition of 5s. in the £, which would be guaranteed.

After some further discussion, it was decided that the debtor should be given 14 days within which to come forward with an offer of a composition of no less than 10s. in the £, suitably guaranteed to the satisfaction of the three principal creditors. The following are creditors:—

	£		£
Belco, Ltd.	182	Knowles, J., Ltd.	12
Harris, J. H.	13	Stella Lamp Co.	37
Hackbridge Cable Co.	23		

Dissolutions of Partnership.—Leicester Road Garage, Uppingham, motor engineers and electricians, Uppingham, Rutland.—Messrs. T. S. Thorpe, S. C. Frisby, and F. B. Glenn have dissolved partnership. Messrs. Thorpe and Frisby will attend to debts and continue the business.

Wheeler and Pearce, electrical engineers and contractors, 218, Rockingham Street, Sheffield.—Mr. H. W. Wheeler and Mr. W. Pearce have dissolved partnership. Debts will be attended to by Mr. Wheeler.

Company Liquidations.—British Road Train Corporation, Ltd.—A petition for the winding-up of this company has been presented to the High Court by Mr. W. Johnson, of the Regent Palace Hotel, Piccadilly, W., and will be heard in London on November 13th.

Bolton Wireless Installation Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. Morris, Court Chambers, Mawdesley Street, Bolton. Meeting of creditors at 4, Bold Street, Bolton, November 9th.

Industrial Intelligence, Ltd.—Winding up voluntarily. Liquidator, Mr. C. Bennett, 4-7, Red Lion Court, Fleet Street, E.C.4.

Falksley Electrical and Cinema Supplies, Ltd.—A meeting of members is called for December 6th at 9, Clinton Street West, Nottingham, to hear an account of the winding-up from the liquidator, Mr. A. B. Sisling.

H. P. R. Wireless, Ltd.—Winding up voluntarily. Liquidator, Mr. R. E. Smith, 79, Mark Lane, E.C. Meeting of creditors at the Liquidator's Offices, November 15th. Particulars of claims by November 30th.

Union Electric Welding Co (Egypt), Ltd.—Meeting of creditors at the offices of Messrs. Maxwell, Scriven & Batley, 29, Great St. Helens, E.C., November 16th. Liquidator, Mr. F. C. Clifte.

Trade Announcements.—The Jackson Electric Stove Co., Ltd., announce that their agent for the Lancashire area is now Mr. R. Millett, Star Buildings, 30, Cross Street, Manchester. Communications hitherto addressed to Mr. Laird, of Liverpool, and to 43, Lower Mosley Street, Manchester, should be directed accordingly.

Mr. A. Southey has opened a wireless depôt at 276, Stamford Street, Ashton-under-Lyne.

The Greengate and Irwell Rubber Co., Ltd., has opened an office at 23, Water Street, Liverpool, under the supervision of Mr. L. F. S. Sington. Stocks of cable and flex, &c., will be held there.

Messrs. Robertson & Buckingham, of 148, Abbey House, Victoria Street, S.W.1, desire to receive catalogues of electrical goods.

Messrs. Siemens & English Electric Lamp Co., Ltd., have opened a store at 2, Wood Street, Cardiff, where they are carrying a large stock of lamps, fittings, cables, accessories, &c., for South Wales.

Catalogues and Lists.—S.R.O. Ball Bearing Co., 115, Southwark Street, London, S.E.—Sixteen-page descriptive price list of their self-aligning adapter bearings, ball-bearing plummer blocks, and shafting hangers.

Messrs. Economic Electric, Ltd., 10, Fitzroy Square, London, W.1.—Forty-page revised catalogue (with revised prices) of radio apparatus and accessories; fully illustrated.

Westinghouse Electric International Co., 2, Norfolk Street, Strand, London, W.C.2.—Eight-page illustrated pamphlet describing twin-motor oil-well drilling equipment for cable tool work.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—Illustrated catalogue (56 pp.) of their ironclad switch and fuse gear. It contains a full account of the design and construction of M.E.M. specialities, including new designs, tables for the installation engineer, and price information revised to date.

Hart Accumulator Co., Ltd., Stratford, London, E.15.—Priced leaflet describing the "Hart" starter batteries for Morris cars.

Messrs. Buck & Hickman, 2, 4 and 6, Whitechapel Road, London, E.1.—A well-bound catalogue (new edition) of their small tools and supplies for engineers, electricians, &c. Considerably over 1,000 pages. Fully illustrated.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.1.—New illustrated publications: No. 372, describing their new two-valve long-range sets; No. 377, detailing the 4-valve long-range set; and No. 378, relating to the "Sterling" and "Magnavox" loud speakers and amplifiers.

Messrs. Johnson & Phillips, Ltd., Charlton, London, S.E.7.—Revised catalogue (28 pages) describing the J. and P. wiring system. Profusely and excellently illustrated.

The Electrical Supplies Co., Ltd., 233, Tottenham Court Road, London, W.1.—November price list of electrical accessories.

The Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, London, W.1.—Illustrated circular No. 89, dealing with the Little Giant BQ-46 hammer drill.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, London, E.C.4.—November trade price list of lamps, domestic appliances, wireless, telephone and other manufactures.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 5,340, describing protective panels for crane motors; No. 5,645, relating to auxiliary current limit switches; and No. 5,649, concerning push-button switches.

Messrs. Croogon & Co., Ltd., 16 and 230, Upper Thames Street, London, E.C.4.—Catalogue No. 108 (24 pages) being an abridged price list of electric lighting material of all kinds, also electric fires, &c.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.2.—Twelve-page catalogue of Brascolite electric light fittings. Priced.

Messrs. Campbell & Isherwood, Ltd., Raleigh Street, Bootle.—Illustrated catalogue (30/40 pages) of electric generating sets up to 250 kW, motor generators, semi-automatic sets, &c.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—Pamphlet briefly describing and illustrating their "Claristal" B.B.C. receiving set.

Electric Heating & Hardware, Ltd., Crown Works, Berkley Street, Birmingham.—Leaflet illustrating and pricing a number of new "Komet" electric fires of Jacobean design; a teapot-type kettle; an octagonal fire; the "Utility" stove and other devices.

Benjamin Electric, Ltd., Tariff Road, London, N.17.—Illustrated and priced booklet dealing with motor-car accessories.

Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Booklet containing illustrations of some of the better-known makes of motor cars on which Exide batteries are included in the standard equipment.

Ateliers de Constructions Electriques de Charleroi, Charleroi.—November list of motors and dynamos in stock.

German Interests in the Zurich Electrical Bank.—Concerning the reports recently circulated respecting the alleged transfer to Herr Hugo Stinnes of the control over the Bank fur Elektrische Unternehmungen of Zurich, the chairman of the Bank (Dr. Frey), at a special meeting just held to adopt a scheme of reorganisation, stated that the rearrangement implied the nationalisation of the undertaking, and that the former large German interests in the bank were now represented by only 9 per cent. of the new share capital. Dr. Frey further repudiated the reports alleging that Herr Stinnes had obtained control, and he has since announced that the bank is now quite independent from a national and a technical point of view. Negotiations had never taken place with the Stinnes group, the c ief of which was neither known to the directors nor to Dr. Frey, nor with third parties on the matter of the German group obtaining an influence in the bank.

Rolling Mill Motors for Belgium.—Addressing the shareholders at the recent meeting of the Belgian John Cockerill Company, the chairman stated that the company some time ago placed an order in England for the supply of a series of electric motors for rolling mills. At that time, when the franc was quoted at 50 in exchange for the pound sterling, the directors had considered that they were prudent in asking to be allowed to pay for the motors in three years. The three years had passed, and it was necessary to settle the matter. The company had been covered for half the amount for some time past, and there was still one half upon which the company would have to bear the difference in exchange. The directors had discussed the question with the contractor, and it had resulted in the obtaining of a material reduction in the prices of the motors, so that the company would not have to expend a much larger sum than the estimate of the directors. The chairman further stated that all who had purchased installations abroad, not only in countries with a high rate of exchange but also in those with a depreciated currency, had experienced "avatars." Those who had bought in Germany had been compelled to make additional payments in order to obtain deliveries, or the supply of the plant was refused; and no benefit had even been gained from the circumstance of working in a country with a depreciated currency.

French Customs Nomenclature.—The Syndicat Professionel des Industries Electriques brought forward on several occasions between 1916 and 1919 a scheme of Customs nomenclature for all kinds of electrical apparatus, which was proposed to replace the obsolete nomenclature from which the industries are said to have suffered since 1892. On the occasion of the institution of a recent inquiry by the French Ministry of Commerce and Industry in order to ascertain the views of the economic groups, the Syndicat Professionel submitted a scheme for a new nomenclature. The project embodies all the articles included in the electrical industry in a specialised form so as not to give rise to any confusion and at the same time aiming at facilitating the task of the Customs House officials in verifying matters. The scheme has been prepared by a committee of the Syndicat Professionel with the co-operation of the syndicates appertaining to the construction of heavy electrical machines, cables and conductors, and electrical heating appliances. It is stated that the scheme has now been approved by the Customs Commission of the Chamber of Deputies, who have adopted the text as a whole in agreement with representatives of the Ministry of Commerce and of the administration of the Customs.

Applications for British Trade Marks.—The following are among the recent applications for British trade marks. Objections to any of the proposed marks may be entered within one month from the dates mentioned:—

B.H. (lettering and design). No. 5. 438,752. Class 8. Circuit-breakers, starting and controlling switches, and the like switchgear.—Brookhirst & Co., Ltd., Northgate Works, Newry Park, Chester. October 31st, 1923.

Concite. No. 440,946. Class 8. Crystals for wireless detectors.—Conradi & Braun, 52, Theobald's Road, London, W.C.1. October 31st, 1923.

Merrlite (lettering and design). No. 434,149, 434,109. Class 13. Reflector arc lights.—The Gaumont Co., Ltd., 5 and 6, Sherwood Street, Piccadilly Circus, London, W. October 31st, 1923.

Winner. No. 438,170. Class 13. Sparking plugs for internal-combustion engines.—Leonard C. Harvey, 25, Victoria Street, Westminster, S.W. October 31st, 1923.

Fluxode. No. 440,221. Class 13. Bare wire electrodes and flux-covered electrodes for use in connection with electric arc welding.—Frank E. Saunders, 14, Victoria Street, Westminster, S.W. October 31st, 1923.

G.A.C. (lettering and design). No. 440,226. Class 13. Electric switches (ordinary), contacts and terminal cut-outs, lamp holders, &c.—The General Accessories Co., Ltd., 125, High Holborn, London, W.C. October 31st, 1923.

Russian Industrial Notes.—*Filament Production in Russia.*—As a new branch of manufacture in Russia, it is stated that the Baskakoff cable works of the Central Electrical Trust is now embarking upon the production of wolfram filaments for lamps. A portion of the necessary equipment for the purpose has already arrived from abroad, and the remainder is shortly expected.

Dynamo Iron.—It appears that the price asked by the Ural Metal Trust for the delivery of dynamo iron, the production of which it is sought to resume, amounts to 15 chervonets per pood at consumers' works. Having regard to the circumstance that foreign iron can be obtained at 8.5 chervonet roubles per pood, the General Electrical Commission, before arriving at a decision as to whether to accept or reject the native offer, has requested the Ural Trust to revise its price.

Porcelain for Electrical Purposes.—The Slavyansk works of the Central Electrical Trust, which produces porcelain for ordinary electrical purpose, is now about to embark upon the manufacture of porcelain for high-tension work for which there is a large demand. At the same time measures are being adopted to intensify the production of porcelain, and it is contemplated to turn out products amounting to 4,000 poods per month in the current financial year, as compared with half this quantity in the year which has just come to an end.

Russian Contracts Abroad.—Mr. Sergieff, chairman of the Russian Union for electrical machinery, is reported by a message from Moscow to have just returned to Petrograd after a long tour in Sweden, Germany and Holland. He states that he has entered into various important contracts with foreign firms which have granted long-term credits, and that the Berlin A.E.G. in particular will take a large share in the reconstruction of the electrical industry in Russia. As a result of the contracts which have been concluded it is said that the different Soviet electrical works will be able to utilise the latest inventions in electrical science.

A Wireless Contract for Persia.—According to the Moscow official organ of the Soviet Council of Labour and Defence, the first foreign contract for manufactures obtained under the present *régime* has just been secured by the Telephone and Telegraph Trust (Weak Current Trust). It is a contract with the Government of Persia for the supply of big wireless installations which will connect Persia with Europe and Asia. The contract comprises installations in Tabriz and in six other towns and four transportable stations. It is stated that the contract has been obtained in competition with companies in Germany, France, and England, which were supported by their respective Governments, and that it has been approved by the Persian Parliament. The value of the order is estimated at 500,000 gold roubles (£50,000), and it is to be executed within a period of ten months.

The Financial Difficulties of Production.—The financial crisis in Russia is not without its effects upon the electrical manufacturing industry. About 80 per cent. of the total output is disposed of to Government departments, great economic organisations which are proceeding to adopt electrical equipment (the Baku and Grosny oil trusts, &c.), tramways and generating stations. Only in the case of lamps, installation materials, light motors, and other products are transactions carried on with the co-operative societies and in the free market. As a result of this state of affairs, the principal difficulties of the manufacturing industry arise in connection with the delays in making payment for orders executed on behalf of the 80 per cent. group. The industry is said to have plenty of orders on hand, and although there is no present possibility of the output being greatly reduced, it is considered that it will be necessary to curtail the production in different departments if the financial crisis assumes a serious course. In the meantime the General Electrical Commission, as the controlling authority, is now engaged upon an inquiry with the object of adopting measures to regulate the present situation.

Italian Electrical Companies.—The last meeting of shareholders of the Società Elettrica Brisciana (capital, 40,000,000 lire) approved the balance for the year to May 31st. The working showed an available profit of 6,916,347 lire, which set aside for the reduction of the loss on the past year from 7,463,800 lire to 547,425 lire. It was also decided to hand over to the shareholders the share in the Società Emiliana di Esercizi Elettrici. The financial problem of the Bresciana company is thus regulated.

The Unione Esercizi Elettrici (Milan) (capital, 80,000,000 lire) closed the working year 1922-23 with a net profit earned of 10,970,725 lire, from which a dividend of 7.50 lire per share, equal to 15 per cent., was distributed.

The Società Anonima per l'Elettro-Agricoltura, of Bologna, has decided to raise its capital from 1,500,000 to 2,500,000 lire, and the Società Lucana Imprese Idroelettriche, of Naples, has advanced its capital from 3,500,000 to 10,000,000 lire.

A modification of its capital situation has been carried out by the Officine Elettrochimiche Dott Rossi, of Milan, by writing down its capital from 9,500,000 lire to 475,000 lire by reducing its shares to 5 lire and thereafter raising them to 100 lire. The capital is then to be increased to 20,000,000 lire by a first issue of 105,000 100-lire shares.

A like transaction has been decided upon by the Società Italiana Conduttori Elettrici Isolati e Affini, of Leghorn, which has reduced its capital from 4,991,140 lire to 2,495,570 lire by writing down its 170-lire shares to 70 lire, while the board has been authorised to raise its capital to 7,000,000 lire.

There has been formed at Milan the Società Anonima Energie Elettriche Alta Valle Seriana for the installation and working of electrical and industrial undertakings and the trade in machinery. Its capital is 100,000 lire in 400 250-lire shares.

The Società Generale Elettrica Tridentina is the style of a firm launched at Milan as an amalgamation of the Società Idroelettrica Alto Noce and the Società Industrie Elettriche Trentine. The capital of the new company will be 17,000,000 lire.

Deed of Assignment.—E. L. Evans Tragas (Waterloo Electric Co.), electrical factor, 129, Waterloo Road, S.E.—Particulars of claims by November 21st to the trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Book Notices.—"Universal Directory of Railway Officials, 1923." London: The Directory Publishing Co., Ltd. Price 20s. net.—The 29th annual edition of the "Universal Directory of Railway Officials," compiled chiefly from official sources, includes the numerous changes in personnel consequent on the grouping of the British railways, also a complete list of the chief railway officials all over the world. The directory is divided into eleven sections, arranged as follows: Official, Great Britain, Ireland, Europe, Asia, Africa, Australasia, North America, Central America, Mexico and West Indies, South America, and Personal Index of Railway Officials.

The Electric Power Club, of Cleveland, U.S.A., has just added to its list of publications a 16-page (two figs.) booklet containing detailed instructions for the proper installation, operation, and care of electric motors and generators, which are grouped under the five following headings: General installation, method of drive, operation, care and maintenance. while motors and generators require less care than almost any type of power apparatus, neglect of certain fundamental requirements may lead to serious trouble, if not to the loss of the equipment. A wide distribution of information of this character is, therefore, important, and these brief instructions have been prepared for the assistance of those responsible for the installation, operation, and maintenance of such plant. Standard definitions referring to motors and generators are also embodied in the booklet.

As from January next, *Beama*, the monthly organ of the British Electrical and Allied Manufacturers' Association changes its name to *World Power*, and it will be associated with the activities of the World Power Conference, which meets in July next.

Punch Almanack for 1924 (1s.) has just appeared. It contains many pages of humorous pictures, including some good colour printing, bearing on some of the customs and fashions of the times.

We have received a copy of the first number of *Twentieth Century Advertising*, a monthly paper, produced in high-class style, and one which should be useful to those who desire to improve the method and manner of present-day advertising. It is published at 2s. 6d. at Bush House, Aldwych, London, W.C.2, and is edited by Mr. Murray Allison.

The *Engineering and Boiler-House Review* consists of the *Engineering Review* supplemented by a section entitled *The Boiler House*, which is conducted by Mr. J. D. Troup, M.I.Mech.E. The latter apparently will eventually appear as a separate monthly journal, and its existence needs no justification in view of the fact, which is gaining recognition every day, that it is in the boiler house that the greatest scope is found for increased economy of heat. The new journal is addressed both to the non-technical user and to the power engineer, and the first issue contains an article by Mr. David Brownlie on "The Importance of the Boiler House," as well as other articles on pulverised fuel, the Spearing boiler, superheated steam, boiler-tube cleaning, &c.

La Radiotéléphonie. By Carlo Toché. Pp. viii+118; figs. 51. Paris: Gauthier-Villars & Cie. Price 10 fr.—This is the second edition of a work aiming to cover the whole of the field suggested by the title, and addressed not only to electricians, but also to the general public. Its contents are practical rather than theoretical, and it deals with the various methods of transmission and reception, range, and application. In a brief preface General Ferrié, controller of the Eiffel Tower installation, heartily commends the work, whilst pointing out the peculiar advantages of wireless telegraphy by continuous waves on account of the greater number of simultaneous communications possible without mutual interference. The book is lucidly written and full of information.

"An Introduction to Wireless Telegraphy and Telephony," by Prof. J. A. Fleming, F.R.S. Pp. xi+112; figs. 65. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

We have received a copy of No. 3 of *Castings Magazine*—a quarterly production issued by the members of the Literary Club of the Falkirk Iron Co., Ltd.

"Science Abstracts" (Sections A and B). Vol. XXVI; Part 10. No. 310. October 25th, 1923. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Modern Electro-Plating," by W. E. Hughes. Pp. vii+160; figs. 30. London: Henry Frowde and Hodder and Stoughton. Price 16s. net.

"The Law of the Car and Every Motorist's Own Lawyer." By L. G. Redmond-Howard and H. Crane. Edited with an introduction and technical notes by W. Gordon Aston; pp. xvii+169. London: Percival Marshall & Co. Price 2s. 6d.

New South African Wireless Company.—The Wireless Co. of South Africa, with a capital of £560,000, has been registered at Cape Town, with Sir Drummond Chaplin as chairman, Colonel Childs (vice-chairman and joint managing director), Sir David Graaff, Sir Jeremiah Wilson, the ex-Postmaster-General, Mr. Joseph Herbert, Mr. Harold Penrose (joint managing director), Mr. Alexander Rennie, Mr. Arthur Rogers-Jenkins, Mr. James Benjamin Taylor, and Mr. Ralph Martin.—*Reuter* (Cape Town).

The Boilermakers' Dispute.—It is announced that the shipbuilding employers and the Boilermakers' Union have agreed to meet in conference in order to see whether a settlement of the shipyard dispute can be reached. The conference will take place to-day in London.

The B.E.A.M.A. and Dominion Trade.—The *Birmingham Post* gives some details of the proposals laid before the Imperial Economic Conference by the British Electrical and Allied Manufacturers' Association, for the substitution of a new tariff basis for the present *ad valorem* duty in our trade with the Dominions. "The Association points out that manufacturers in the United Kingdom suffer because here the aim is to maintain the highest possible standard of living for the workers. The shorter hours of labour and higher wages result in increased cost of production, which makes the home market price high relatively to other countries where the conditions are much less favourable to the workers; this carried out to its logical conclusion means that in exporting to the Dominions, in competition with a foreign manufacturer with a lower home standard of living, the British manufacturer is penalised, and has, under the anti-dumping legislation, to pay the difference between home market prices and export prices, thus effectively wiping out the preference to the British manufactures. The Association, therefore, submits that the anti-dumping legislation has proved to be injurious to United Kingdom manufacturers and to be without a corresponding advantage to the Dominions. The anti-dumping legislation cannot be effective in the sense in which it was intended, as it is impossible to check home market prices owing to the various methods of distribution adopted in different countries. The weight or unit basis has already been adopted as the basis of assessment in some of the Dominions, and there will be no great difficulty in adopting this basis rapidly throughout the Empire. It is, therefore, urged that present import duties throughout the Empire, now on an *ad valorem* basis, should be levied at certain specific rates based on weight, volume, or number. In suggesting this change of basis, the Council states it does not desire to reduce the revenue derived by any Dominion from Customs duties, but, on the other hand, considers that the prevention of the under-valuation of imports would increase revenue. Regarding anti-dumping legislation, the Council contends that with the adoption of specific rates of duty based on wages, or other definite units, anti-dumping legislation would become unnecessary, as the interests of the manufacturers in the various Dominions could be adequately safeguarded by the imposition of special rates of duty. It is further urged that the present various classifications adopted by different Dominions and the United Kingdom should be replaced by a uniform classification, and that a simplified and standard declaration form in connection with the Customs should be adopted."

Unemployment.—The number of persons on October 29th, 1923, recorded on the live registers of the Employment Exchanges in Great Britain was 1,256,000. This was 6,563 more than in the preceding week, and 229,878 less than the figure recorded on January 1st, 1923. The total included 943,200 men, 41,500 boys, 233,800 women, and 37,500 girls.

Belgian Companies.—An extraordinary general meeting of the Société d'Electricité du Borinage, at Pâturages, has decided to raise the company's capital from 8,000,000 to 15,000,000 fr., with a view to undertaking the construction and working of central stations and distribution networks, tramways, railways, and other means of transport.

There has been formed at Brussels the Société d'Enterprises Electriques en Pologne for the acquisition and working of electrical concessions and undertakings of all kinds in the Republic of Poland. Its capital is 10,000,000 fr. in 40,000 shares, all of which are taken up by Belgian electrical undertakings (4) and banks (5). The promoting undertakings are the Société Générale Belge d'Entreprises Electriques, the Société Générale de Chemins de Fer Economiques, the Société Financière de Transports et d'Entreprises Industrielles, and the Société d'Electricité et de Traction.

The Compagnie d'Electricité des Ardennes has been embodied at Liége, with a capital of 1,500,000 fr., for the generation and supply of electricity, the working of concessions, &c.

With a capital of 2,000,000 fr., the Etablissements Industriels et Commerciaux R. A. Lister et Cie. has been constituted as the Société Anonyme at Landen, with the object of making and selling electrical, agricultural and dairy machinery of all kinds.

There has been established at Malmédy the Centrale d'Electricité, Eau, et Gaz de Malmédy for the manufacture, purchase and supply of all substances required for heating and lighting and the installation and working of water, gas and electric undertakings. The capital is 300,000 fr.

The Verreries Bruxelloises is the style of a company formed

at Brussels (48, Rue de l'Industrie) for the manufacture of electric lamp bulb and other electric glass objects. Capital, 375,000 fr.

The Société de Recherches Radioelectriques Emmanuel Buchet et Cie. has been constituted a company, with offices at 108, Avenue, Ducpétiaux, Saint Gilles-les-Bruxelles, for the purchase, manufacture and sale of the raw and wrought material of wireless telegraphy, radiology, electrical medicine, &c. The capital is 155,000 fr.

Oil Purifiers.—The De Laval Chadburn Co., Ltd., London, points out a misprint on page 623 of our issue of October 26th in the description of the Diesel-electric ship *La Playa*. Near the end of the article a "De Laval Air Purifier" is referred to, where "oil purifier" should be read. We understand that this type of purifier, which we fully described in our issue of September 16th, 1921, has been installed on more than 450 merchant steamers.

Searchlight Projectors.—In the description of the new P. & O. passenger vessel s.s. *Maloja*, on page 675 of our last issue, it is mentioned that amongst other electrical equipment a 20-inch searchlight with Parsons patent split mirror is used. We are informed that this machine was supplied by the London Electric Firm, of Croydon, together with one for the sister vessel for this company. The firm is frequently supplying this type of searchlight, which has special characteristics for navigating the Suez Canal.

Strike Settled.—With reference to the strike of electricians at Whitehall on H.M. Office of Works contracts, the following notice, dated November 6th, was issued to all London area members of the National Federated Electrical Association by Mr. Leonard G. Tate, the secretary of the branch:—

"*Re* Unauthorised Strike on H.M.O.W. Contracts.—I have to inform you that the above has now terminated, the men having restarted work on Monday, November 5th, 1923. My request of October 10th, that any employer of electrical labour should communicate with me before engaging additional men, is therefore now withdrawn."

Catalogues Wanted. — Messrs. Z. W. Trading Co. (Minories), Ltd., of 124-127, Minories, E., wish to receive trade price lists of wireless apparatus, accessories, &c.

Employment in India.—A correspondent informs us that he has lately heard from a very reliable source in India that the unemployment difficulty in the East calls for very careful attention from men contemplating changing over from this country to abroad. It seems that men are going out to Bombay where, having neither work nor money, they have to be helped by Europeans. He says that electrical men seeking employment should be warned not to go unless they have a definite position backed with a passage. "There are hundreds of Indians, better educated, and willing to take on jobs at half a European's salary. The only European who has an earthly chance is the man with 'pep' for publicity and salesmanship, and, above all, tact. He will want yards of the last if he is to bargain with the natives now."

Copper and Lead Prices.—Messrs. F. Smith & Co. report November 7th:—Copper (electrolytic) bars, £65, 30s. increase; do. do. sheets, no change; do. do. wire rods, £75, 30s. increase; do. do. h.c. wire, 9 7/16d., 1/16d. increase.

Messrs. James & Shakespeare report November 7th:—No change in copper and lead prices.

The Manufacture of Boilers in Canada.—The Montreal correspondent of the *Financial Times* records that Babcock and Wilcox, Ltd., of London, Goldie, McCulloch & Co., of Galt, Ontario, and Babcock & Wilcox, Ltd., of New York, have organised a new Canadian company to undertake the manufacture of boilers, &c., in the Dominion. The name of the new company is Babcock, Wilcox & Goldie McCulloch, and the head office and works are at Galt, with offices in Vancouver, Winnipeg, Toronto, and Montreal. Mr. R. A. McCulloch is the president, and the directors include Sir James Kemnal.

The Lord Mayor's Show.—The programme for the Lord Mayor's Show, in the City of London to-day, includes features of electrical interest, namely:—

Marvels of Modern Science.
The Electrical Industry To-day.
(Car by Electrical Development Association.)
Wireless Concert Band of the Irish Guards by the British Broadcasting Company.
The Car of the British Empire Exhibition, 1924.

Lead.—In their report, dated November 3rd, Messrs. James Forster & Co. say:—"Consumption is no doubt increasing both in the domestic (sheet and pipe) and electrical cable trades. The output for the former up to the end of September for the nine months averages a little over 6,500 tons. The consumption in the electrical trades, if there are no hidden stocks, as is asserted, must have been much greater than has been reported. The fact remains that the September arrivals, minus exports, were twice the average monthly quantity for 1922, and yet scarcity has prevailed during the whole of October."

New Australian Companies.—Among the companies recently registered in Australia are: Broadcasters (Sydney), Ltd., £1,000 capital, to establish and conduct a broadcasting station in Australia; The Electrical Plant Manufacturers, Ltd., £50,000 capital, to carry on business as electrical engineers and contractors, dealers, &c. (Mr. G. Weymouth is one of the directors); Railways & Tramways Equipments, Ltd., £20,000 capital, to take over as a going concern the assets patent of the Automatic Retrieving Trolley Pole Syndicate.

For Sale.—Wigan Coal and Iron Co., Ltd., invites offers for a nine-panel switchboard, 40 50-h.p. motors, and one 100-kW rotary-converter. St. Helens Industrial Co-operative Society has for disposal surplus generating plant, comprising a Lancashire boiler, feed-water pumps, engines, dynamos, &c. Chesterfield Corporation Electricity Department invites offers for two Belliss & Morcom compound engines, direct coupled to two Westinghouse 100-kW generators, with steam pipes, &c. Messrs. Clarke & Dovey will sell by auction on November 14th, at 122, Wellington Street, Cardiff, the stock, machinery and plant of Messrs. Morgan & Taylor's, Radio Electric, Ltd. (in voluntary liquidation), wireless and electrical engineers. (See our advertisement pages to-day.)

Forthcoming Exhibitions.—The following exhibitions have been organised:—

London.—Commercial Motor Exhibition. November 22nd-December 1st; British Empire Exhibition, April to October, 1924; British Industries Fair, White City, April 28th to May 9th, 1924.

Birmingham.—British Industries Fair, May 12th-23rd, 1924.

Norwich.—Ideal Homes and General Trades Exhibition, January 31st-February 9th, 1924.

Warrington.—Industrial Trades Exhibition, February 6th-16th, 1924.

New Zealand (*Hokitika*).—British Inter-Colonial Exhibition, December 15th to February 3rd, 1924.

Australia (*Melbourne*).—Electrical Exhibition, September, 1924.

Hydro-Electric Contracts.—Among recent contracts for hydro-electric power undertakings, Messrs. Armstrong, Whitworth & Co., Ltd., report the following:—

Seven Francis-type water turbines of 14,000 h.p. each, for the Newfoundland Power & Pulp Co.

Two Pelton wheels, each of 7,500 h.p., for the Aluminium Corporation, Dolgarrog, N. Wales, for whom they are also remodelling an old Ganz wheel to increase the output to 1,800 h.p.

Two Francis-type turbines of 600 h.p. each, for Grafton, New South Wales; and

One Francis-type turbine of 180 h.p., for Thibet.

LIGHTING AND POWER NOTES.

Airedale.—Electricity Supply.—Under the agreement between the Keighley Corporation and the Yorkshire Electric Power Co. in regard to the supply of electricity to Skipton, the Keighley Electricity Committee now recommends approval of the Power Co. using energy supplied under that agreement for supplying consumers in the intervening parishes of Glusburn, Grosshills, Kildwick, and Carleton, subject to the total amount supplied not exceeding 250 kW. The committee also recommends the laying of cables to Oakworth, at an estimated cost of £450.

Barnstaple.—Price Reduction.—The Town Council has reduced the charges for electricity for cooking to 4d. per kWh for the first 200 kWh per quarter, and 3d. per kWh beyond; and for heating offers a flat rate of 3d. per kWh.

Barrow-in-Furness.—Electricity Supply.—The erection of the overhead cable to supply electricity to the Anticross iron-ore mine at Dalton has been commenced. Preparations are being made for supplying electricity in bulk to Ulverston, and it is hoped the Corporation and the Dalton District Council will shortly come to terms with regard to a supply to the Dalton township and district.

Blackpool.—Loans.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £5,000 for meters. Sanction has been received to the borrowing of £22,000 for transformers, &c.

Burnley.—Proposed New Power Station.—The Town Council has decided to apply to the Electricity Commissioners for authority to erect a new power station near Padiham. Coun. Nuttall said it was expected three years would elapse before the station could be built, but they were anxious to expedite the scheme because a private company had already porposals in hand. It was important that the two projects should be considered by the Commissioners at the same time. For this purpose the Electricity Committee recommended that financial and technical experts should prepare a scheme. It was in the interest of the district, he thought, that the Corporation should continue to own any power station that supplied electricity in the area.

Mains Extensions.—The Electricity Committee has decided to extend the mains to the Marsden Road district at an estimated cost of £1,350.

Continental.—Belgium.—La Compagnie d'Electricité de la Dendre, of Brussels, has recently acquired the controlling interest in the Société d'Electricité Canton de Lens, which supplies electricity for lighting and power purposes to 18 communes. Part of the energy is generated by the company itself, while the remainder is obtained from the plant at a neighbouring colliery. As a result of the new arrangement, the whole of the electricity required for the Lens undertaking will be supplied by the Dendre Co., which is increasing the capacity of its generating station at Deux-Acren from 9,000 to 15,000 kW by the addition of a 6,000-kW turbo-generator.

Spain.—A concession has recently been granted by the Spanish Government for the establishment of a plant to utilise the water power of the River Rudron, near Valdelateja (Province of Burgos), for the generation of electrical energy for lighting and power purposes.

Russia.—*The Volkhov Hydro-Electric Works.*—The chief engineer of the projected big hydro-electric works at Volkhov, in the course of an interview, is reported to have stated that the dams are expected to be completed in the present financial year, and that it is possible the station will be able to supply energy to Petrograd in April, 1925. It would be possible to furnish to Petrograd over 150,000,000-kW hours per annum, which would be equivalent to a coal economy of 176,000 tons. The whole question, however, depended upon the allocation of sufficient funds by the State for the continuance and completion of the works.

The Moscow Region.—According to a Moscow newspaper, it is reported that the prospects of the supply of energy in the new financial year which has just been entered upon are fully satisfactory. During the past season a new 10,000-kW turbine has been installed at the station of the former lighting company of 1886, being the first since 1914. This was obtained from abroad, and in the near future the arrival is expected from England of a boiler from the firm of Babcock & Wilcox, Ltd. Alterations have also been made to the boilers and other mechanical equipment at the electric transmission station, and new transformers have been erected at the sub-stations. The aggregate capacity of all the stations under the Union amounted to 90,000 kW on October 1st, 1923, excluding the new turbine already mentioned. The production of energy in the Moscow city area in 1922-23, excluding that for the tramways, totalled 150,000,000 kWh for lighting and power purposes, this quantity exceeding the maximum of 141 millions in 1916. At the same time the number of customers has increased from 80,000 to 160,000 in the past few years. The supply of fuel, both petroleum and peat, is declared to be assured for the ensuing 12 months.

Deal.—Special Order.—The Town Council has decided to raise no objection to the application of Sir Charles Bright and Partners for a Special Order to supply electricity in the borough.

Dingwall.—Electricity Order.—The Strathpeffer and Dingwall Electric Co., Ltd., has applied for an Order to supply electricity at Dingwall, Rosskeen, Alness, Kiltearn, Fodderty, Contin, Urquhart, Logie Wester, Urray, Kilmorack, Kirkhill, Inverness, and Bona.

Elland (Yorks.).—Street Lighting.—A sub-committee of the Urban District Council has under consideration a scheme submitted by the electrical engineer for the conversion of the whole of the street lighting to electricity. If the scheme is adopted application will be made for financial assistance from the Unemployment Grants Committee.

Gillingham (Kent).—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to a loan of £9,821 for the installation of Diesel engines.

Indo-China.—Haiphong.—According to *Eastern Engineering*, the Société Indo-Chine d'Electricité is to increase the capacity of its power station at Haiphong by 1,500 kW. The cost of carrying out the improvements will be 2,500,000 fr.

Irish Free State.—Navan.—We regret that in our note in last week's issue, referring to the inauguration of the electricity undertaking, we omitted to mention that the work was carried out under the direction of Mr. J. J. Woods, consulting engineer, of Dublin, who was responsible for the scheme.

Thurles.—At the request of the Ministry of Industry and Commerce, the system of electric lighting is to be changed from direct to alternating current.

Leyland.—Bulk Supply.—The Urban District Council is applying to the Electricity Commissioners for an Order authorising it to obtain a bulk supply of electricity for the district. Subject to satisfactory terms being arranged, Mr. J. A. Robertson has been appointed engineer.

Linlithgow.—Electricity Supply.—The Town Council is negotiating with the Scottish Central Electric Power Co. for a supply of electricity for the borough.

Mid-Lancashire Electricity District.—Local Inquiry.—The Electricity Commissioners are to hold an inquiry at Preston on February 20th next with reference to the re-organisation of electricity supply in the Mid-Lancashire area.

Nelson.—New Plant.—At a meeting of the Town Council on October 31st, the Unemployment Grants Committee approved, for the purpose of grant, of the installation at the electricity works of a 6,000-kW turbo-generator, complete with surface condenser and auxiliaries, converting plant, and switchgear. The Town Council is to apply to the Electricity Commissioners for sanction to the borrowing of £34,094 for the provision of an additional boiler.

Northern Ireland.—Belfast.—The Corporation is applying to the Electricity Commissioners for sanction to a loan of £1,000 for the purchase of electric cookers.

Sheffield.—Extension of Supply Area.—The City Council is applying to the Electricity Commissioners for a Special Order authorising it to extend its area of electricity supply so as to include the rural district of Norton and the parish of Coal Aston.

Electricity in Bulk.—The Electricity Committee has recommended that an agreement be entered into with the Dronfield Urban District Council for giving a bulk supply of electricity to the urban district.

Mains Extensions.—The Committee has decided to carry out extensions to the electricity mains at an estimated cost of £5,791.

South Africa.—Bloemfontein.—At a recent ratepayers' meeting objections were raised to the Town Council's proposal to raise a loan of £100,000 for the erection of a new power station. A poll was demanded, which has resulted in the Council's scheme being agreed to. The new power station will have a capacity of 7,500 kW, and the cost is estimated at £180,000.

Beaufort West (Cape Province).—The ratepayers have decided in favour of the Town Council's proposal to erect a new power station at an estimated cost of £14,000. The town has for some time obtained a limited supply from the railway power station.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them, authorising the Morecambe Urban District Council to supply electricity in Morecambe, the Hawarden Rural District Council to supply electricity in certain parishes and townships in the rural district of Hawarden, the Thames Valley Electric Supply Co., Ltd., to supply electricity within the borough of Henley-on-Thames and parts of the rural districts of Henley and Wokingham, the Urban District Council of Newmill to supply electricity in the district, the Electrical Distribution of Yorkshire, Ltd., to supply electricity in the urban districts of Gildersome, Hunsworth, Birkenshaw, and Drighlington, and the Town Council of Port Talbot to supply electricity in the borough.

Stainforth.—Electricity Supply.—An agreement having been made between the Hatfield Main Colliery and the Electrical Distribution of Yorkshire, Ltd., a Special Order is to be applied for, and if this is granted it is expected that the district will be electrically lighted before the end of 1924.

Torquay.—Loans Sanctioned.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £3,500 for mains and services and £1,000 for meters.

United States.—Hydro-Electric Development.—The Arizona Highline Reclamation Association has filed an application with the Arizona State Water Commissioner for authority to carry out a scheme of hydro-electric development in the State. The engineer's report states that over 1,000,000 h.p. could be generated, but that it is advisable to recommend the development of 750,000 h.p. as part of the initial development.—*Journal of Electricity.*

Welshpool.—Electricity Supply.—The Town Council has decided not to support the application of the Gas Co. for authority to supply electricity in the district, but to make application for its own Order.

West Riding (Aire and Calder) Electricity District.—Local Inquiry.—The Electricity Commissioners have issued a draft order establishing a Joint Electricity Authority for the above-named district, and in connection therewith they are to hold a local inquiry at the Town Hall, Bradford, on December 4th at 10.30 a.m., and following days if necessary.

Wimborne.—Revocation of Orders.—The Ministry of Transport has revoked the Wimborne and District Electric Lighting Orders of 1905 and 1912.

Wolverhampton.—Supply Area Extension.—Application is to be made for a Provisional Order to enable the Corporation to extend its supply area by some 10,000 acres on the north side of the borough in the direction of Codsall, Shareshill, and Brewood. The object is to empower the undertaking to supply an area covering the greater portion of the Cannock rural district, including parts of Essington, Hilton, Featherstone, Shareshill, Brewood, Oaken, Codsall, and Wrottesley (detached). The supply area now covers over 15,000 acres, in which are 46 sub-stations, compared with a modest eight before the war. The new area will make the total about 25,000 acres.—*Birmingham Post.*

York.—New Plant.—The Electricity Committee has received a report from the electrical engineer pointing out the necessity of installing further boiler plant at the generating station to meet the winter load of 1924-5, at an estimated cost of £32,650. The Committee has approved the report, and plans are to be prepared and tenders invited for the work.

TRAMWAY AND RAILWAY NOTES.

Australia.—MELBOURNE.—The electric tramways operated by the Melbourne Tramways Board earned a total revenue of £661,456 for the year ended June 30th last—an increase of £60,645. The working expenses amounted to £503,166, leaving a gross surplus of £158,321, out of which £71,841 was paid in interest on stocks and debentures. The number of passengers carried was 70,811,393, and the car mileage increased by 63,438 to 6,742,428.

Blackpool.—LOAN SANCTIONED.—The Town Council has received the sanction of the Ministry of Transport to the borrowing of £30,829 for the following purposes:—Eight new cars, engineering shops, tower wagon, &c.

Colne.—WEEKLY TRAMWAY PASSES.—The Town Council is introducing a scheme of weekly passes on the tramways. The charge will be 2s. for a weekly pass.

London.—L.C.C.—The Highways Committee has recommended to the London County Council that application be made to Parliament next session for authority to construct the following tramways:—(1) Southend Village to Eltham, *via* two new main roads to be constructed across Downham. (2) West Norwood to the Crystal Palace. (3) Southwark Bridge Road terminus to a point near Upper Thames Street, *via* Southwark Bridge. (4) Waterloo Road terminus to a point near the south end of Waterloo Bridge, *via* Waterloo Road. The estimated cost of carrying out these schemes is £598,746.

TUBE RAILWAY EXTENSIONS.—On November 19th the new extension line from Golder's Green to Hendon will be opened for traffic. The Underground Co. has prepared an interesting film, which tells the story of the construction of this line from the inaugural ceremony of "cutting the first sod" in June, 1922, to the present time.

Two new railway stations—West and North Acton, on the G.W.R. section of the Central London tube extension between Ealing and East Acton—were opened on November 5th. Acton, with a population of 60,000, now has nine stations.

STRIKE.—A lightning strike of tramway employés of the Metropolitan Electric Tramways Co. occurred on November 6th. The dispute was due to the transference of a traffic regulator from Paddington to another station. The man was at first dismissed for alleged neglect of duty, but was later reinstated. The strike took place without the authority of the Transport and General Workers' Union.

The Union announced the same evening that the strike was due to a regrettable misunderstanding and had been settled to the satisfaction of both parties. The tramway service was resumed on November 7th.

Plymouth.—PROPOSED TRACK RENEWAL.—An important suggestion for relieving unemployment in the town was made by Sir Arthur Shirley Benn, one of the M.P.'s for the borough, in a speech on October 26th. He urged the Corporation Tramway Committee to replace the present light tramway track with heavy rails. There are still about 22 miles of light rails on the Plymouth system which were originally put down for horse tramcars. Sir Arthur said this would have to be replaced in the near future, and it was an opportune time for the Council to relay 40 or 45 miles of track with heavy rail. He suggested that the Corporation should apply to the Government for the £200,000 or £250,000 required.

LOAN.—The Tramway Committee is applying to the Ministry of Transport for sanction to a loan of £20,000 for the reconstruction of the tramway track in Martin Terrace, Keyham, and part of St. Levan Road from North Gate to Rocky Hill.

Railway Electrification.—L.M. & S. RAILWAY.—The £14,000,000 development plans of the London, Midland and Scottish Railway, referred to by the Prime Minister in his recent Swansea speech, include the early electrification of the Manchester-Oldham line. This is part of the policy for electrifying the lines in the northern suburbs of Manchester to deal more adequately with the increasing population.—*Evening News.*

SOUTHERN RAILWAY.—Plans for the electrification of the suburban area of the Southern Railway to Guildford and Dorking have been approved, and work is to be commenced at once. The total cost of the work authorised is estimated at £5,250,000, and it is anticipated that electrical services will be in operation by the end of 1925.

Rotherham.—WEEKLY TRAMWAY TICKETS.—The Corporation has introduced a system of weekly tramcar tickets. The experiment will be made over a period of three months, and the charges will be from 1s. 6d. on the penny stages to 4s. per week on the 3½d. and 4d. stages.

Scarborough.—SERVICE SUSPENSION.—Scarborough was without a tramway service on November 5th, as the company, which was started 19 years ago, has been financially unsuccessful. Suspension was ordered by the liquidator, and resumption of the service depends on the success of negotiations for the sale of the property.—*Daily Mail.*

Wolverhampton.—RAILLESS CARS.—The new railless-car service to the Heath Town and Wednesfield area was formally inaugurated last week.

TELEGRAPH & TELEPHONE NOTES.

Greece.—RADIO SERVICE.—An agreement for the installation of a wireless service throughout the whole of Greece was come to on November 2nd between the Greek Government and the Marconi Co. It will be ratified by the National Assembly. A Franco-Greek company is negotiating to install a wireless telephone system between the principal towns of Greece and the Eiffel station in Paris.—*Financial Times.*

Irish Free State.—METEOROLOGICAL BROADCASTING.—The Ministry of Industry and Commerce (Marine Department) has issued invitations to shipowners, ship masters, officers, and all interested in meteorology to meet at the office, 27, Eden Quay, Dublin, on November 19th at 4.30 p.m., to meet Commander L. A. Brooke-Smith, R.D., R.N.R., Marine Superintendent, British Air Ministry, who will deliver an address on the work of his office and the latest system of radio weather forecasting. The meeting is in connection with the Marine Agency set up by the Irish Free State Marine Department.

Mexico.—RADIO STATIONS.—It is reported that the Mexican Government has ordered four radio stations in Germany so as to connect the capital with the republics of Guatemala, Costa Rica, San Salvador, and Nicaragua.

Radio Apparatus at Sea.—P. & O. LINER "MALOJA."—The s.s. *Maloja*, the latest addition to the Peninsular and Oriental Steam Navigation Co.'s fleet, which left London on her maiden voyage on November 2nd, has been equipped with the following apparatus by the Marconi International Marine Communication Co., Ltd.:—A 1½-kW quenched-spark transmitter of 700 miles range; a 1½-kW continuous-wave valve transmitter with a range of 1,500 miles; and a Marconi marine direction-finder, which enables bearings to be taken of other transmitting stations within one degree of accuracy. The four-electrode valve amplifying detector is used in the receiving system. The emergency transmitter, with an independent power supply, has a normal range of 100 miles.

DIRECTIONAL APPARATUS.—After experimenting for many months with the *Mauretania*, the Cunard Line has decided that directional gear is a great factor for added safety, and is fitting it in all its passenger ships, says the *Evening News*. The recent disaster to the American destroyer flotilla made the company go into the matter very carefully. It is proved quite clearly, however, that no confusion can arise when the gear is fitted on board the ship, and not on shore.

Radio-Telegraphy.—LOW-POWER TRANSMISSION.—Senator Marconi, who is at present in Rome, confirms the report that he has perfected an invention whereby only a fraction of the power formerly necessary is needed to transmit radio messages. He states that he has narrowed the direction of transmission, thereby assisting secrecy, and he has increased the speed of transmission enormously also. Senator Marconi says that with his latest invention he has been able to correspond regularly from England with the Cape Verde Islands, more than 3,000 miles, using only 1/100th of the power formerly employed.—*Daily Mail.*

The Telephone Service.—LONDON "TOLL" EXCHANGE.—The "toll" system of dealing with short-distance trunk calls which was introduced by the Post Office some time ago has resulted in a marked growth in the traffic. The average daily number of calls to places within the area now covered by the "toll" exchange was 14,000 before the introduction of the "toll" system, and it is now 24,500. Some hundreds of demands are, however, still made each day for "trunks," although the exchange required is reached by the "toll" system. It is in the interests of telephone users to avoid the delay thus caused; they are therefore advised to consult the list of exchanges in the "toll" system in the preface to the London telephone directory before passing a demand for a short-distance call.

NEW LONDON EXCHANGE.—A telephone exchange, to be known as the "Royal," was opened on the 3rd inst. in Great Tower Street, E.C., and, with 22,000 lines, it will be one of the largest. The new exchange takes the place of the one known as the "Minories"; 1,840 subscribers' lines were transferred, but their numbers remain unaltered.

NEW SOUTHALL EXCHANGE.—A new exchange was established at Southall on November 2nd, when 250 subscribers' lines were transferred from the Ealing exchange.

NEW ROSSENDALE EXCHANGE.—In order to meet future developments in the Haslingden, Rawtenstall, and Waterfoot areas, a new exchange known as "Rossendale," situated in the new sub-post office at Rawtenstall, was opened on November 3rd. The existing exchanges at Haslingden, Rawtenstall, and Waterfoot will be closed. The new exchange will be worked on the central battery system. Most of the subscribers' lines have been placed underground, and additional junction and trunk lines existing between other exchanges and the present exchanges at Haslingden, Rawtenstall, and Waterfoot will be diverted to the new exchange, and additional lines will be provided to Manchester, Blackburn, and Burnley.—*Manchester Guardian.*

HULL PROFITS.—Hull Corporation telephone department made a profit during the past half year of over £10,000, after paying more than £5,000 in royalties to the Government.—*The Times.*

LARGE STORES LIGHTING.

Messrs. Lewis's Interesting Installation.

During the last few years Messrs. Lewis's, Ltd., have been having their large stores at Liverpool (two), Manchester, and Birmingham rewired and the electric lighting has been entirely remodelled. At the outset they appointed Messrs. Henry Lea & Son, of Birmingham and Liverpool, as their consulting engineers, and this firm has been responsible for designing and supervising the whole of the work. All four buildings are now very nearly completed, but Messrs. Lewis's are about to more than double the size of their Manchester building, and also intend shortly to commence rebuilding the Birmingham stores, absorbing considerably more area; in fact, the Birmingham building will be an island site eventually.

It is interesting to note that all Messrs. Lewis's buildings have been lighted on the totally-indirect system, about the merits of which Messrs. Henry Lea & Son are enthusiasts. We doubt whether any other stores proprietors in the country have adopted this method of lighting on such a scale. The bowls used are mostly composition plaster of suitable design, with internal reflectors, and contain in some cases three 300-watt gasfilled lamps, fig. 4, but in most cases single lamps of from 100 to 300-watt size; bronze bowls have been used in the smaller stores at Liverpool. The effect is very good, and gives the impression of sunshine. Even distribution of light and absence of glare or shadows, together with excellent illumination from a colour point of view, are some of the advantages claimed on behalf of the totally-indirect method.

The whole of the circuit wiring has been run in galvanised solid-drawn screwed conduit, but whereas at Birmingham and in the first portion of the Liverpool building the tubing was laid in chases cut in the concrete, with traps over all draw-in boxes, the subsequent adoption of tile bricks and asphalt floorings necessitated running the tubing on the surface of the ceilings. In buildings of this kind little objection can be found against surface work, for with symmetrically-arranged tubes painted to match the decoration, the tubes are hardly visible. The a.c. mains at Liverpool are three- and four-core, but all d.c. mains in the Manchester and Birmingham buildings are v.i.r. cable in screwed conduit.

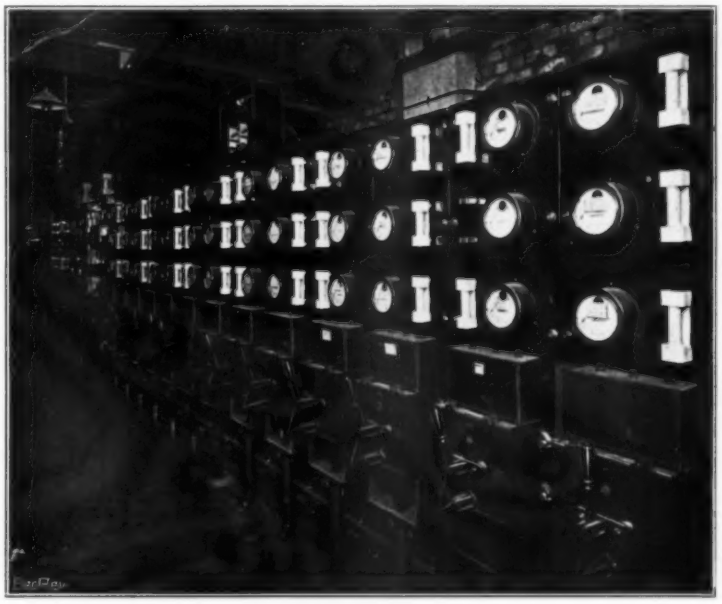


Fig. 2.—Main Switchboard at Liverpool, with Temporary Mains showing Overhead.

Every building was completely tubed before any wire was drawn in, and some 9,200 boxes of all shapes and sizes were utilised to facilitate the drawing in. At Manchester, where plastered girders had to be tubed round in innumerable instances, the engineers avoided the use of ordinary draw-in boxes by devising a special slotted tube, fig. 6, in which half the tube is cut away for about 4 in. This proved an admirable drawing-in device, and the slotted portion is covered up by means of a semi-circular steel cover which is so made as to spring into position. When completed, the conduit looks, from the floor level, like an ordinary piece of tubing.

At Liverpool, after a considerable portion of the one stores had been wired for d.c., the Corporation intimated that the supply was to be changed to a.c., so the necessary alterations were put in hand and a new a.c. switchboard 61 ft. long was installed. A shorter d.c. board is still in use, but only a few lifts and other motors are now supplied with d.c.

Eight services are involved in this one premises. At the top of the board, shown in fig. 5, will be noticed terminals in considerable number; the board was designed so that the whole of the interconnection of main switch, local switches, and fuses was provided by the makers. Thus, the board could be fixed

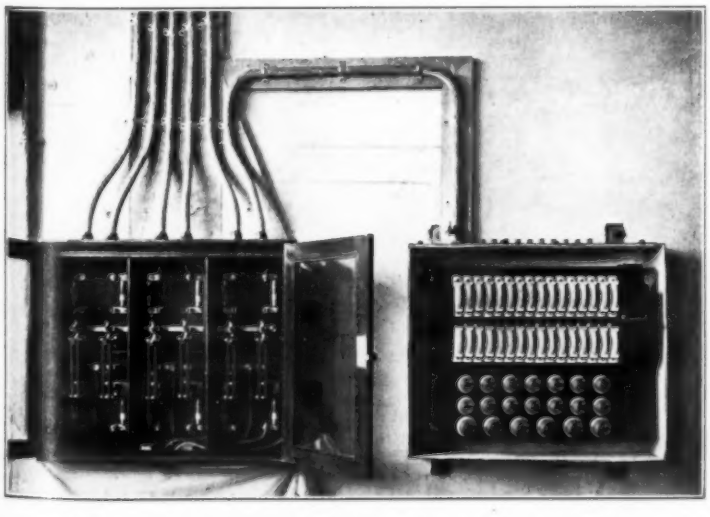


Fig. 1.—One of the Splitters, Switch, and Fuseboxes Used in the Departments at Liverpool.

permanently as delivered, and the circuit wiring had to be merely connected up to the special terminals on the top of the board, the mains being taken into the main d.p. switch terminals at the bottom of the board. The boards were enclosed in cast-iron boxes, encased in polished mahogany cases with glazed doors, and have a handsome appearance.

The following table shows the approximate amount of

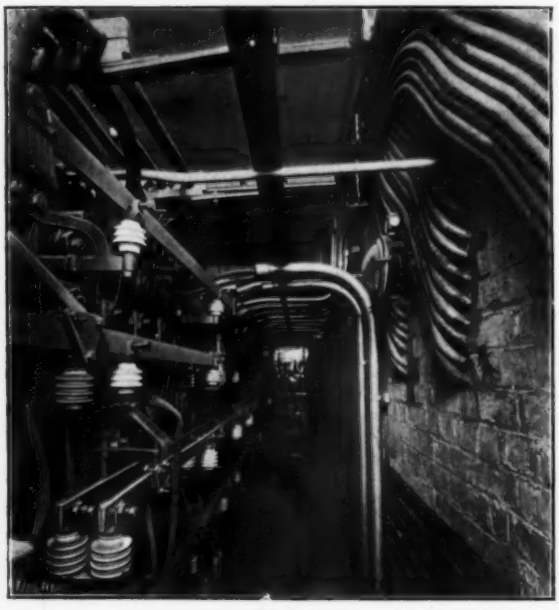


FIG. 3.—THE BACK OF THE SWITCHBOARD AT MANCHESTER.

principal material which has been used so far in Messrs. Lewis's two buildings in Liverpool, the one in Manchester, and the one in Birmingham. It is obvious that by the time the Manchester house is more than doubled, and the Birmingham house rebuilt in its enlarged form, the combined installations must prove to be one of the largest privately-owned concerns in the country.

FIG. 4.—FIRST FLOOR AT LIVERPOOL, SHOWING SOME OF THE LARGE BOWLS, EACH OF WHICH CONTAINS THREE 300-WATT GAS-FILLED LAMPS.

MATERIALS USED TO END OF SEPTEMBER, 1923.

147 miles of wire.

31¼ miles of conduit.

9,200 draw-in boxes of all descriptions.

4,362 lamps in use.

8,822 total amperage at 230 volts, or equivalent, for lighting and power.

Most of the work has been done by Messrs. Lewis's own wiremen working to the instructions of the engineers, who wish to put on record their appreciation of the foremen, Messrs. F. George, A. Oliver, and A. F. Meylan, whose assistance has been of great value. The following contractors supplied the bulk of the material:—

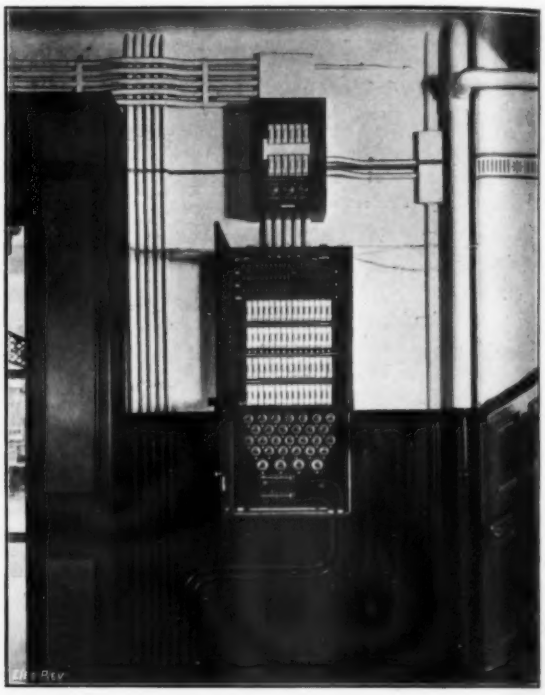


FIG. 5.—A DEPARTMENTAL SWITCHBOARD AT MANCHESTER.

Conduit.—Simplex Conduits, Ltd.; Credenda Conduits Co.; and Metallic Seamless Tube Co., Ltd.

Wire.—W. T. Henley's Telegraph Works Co., Ltd.

Switchboards, Fuseboxes, &c.—W. McGeoch & Co., Ltd.; Liverpool Corporation Electricity Supply Department; Lea, Son & Co., Shrewsbury; G. P. Dennis, Ltd., and Walker Bros.

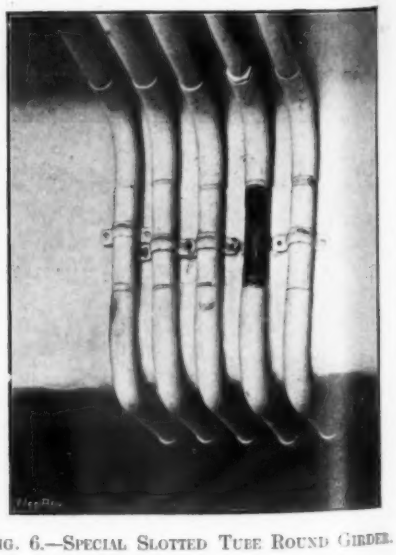


FIG. 6.—SPECIAL SLOTTED TUBE ROUND GIRDER.

Bowls.—Smith & Ansell, Ltd.; and Best & Lloyd, Ltd.

As showing Messrs. Lewis's belief in electricity as an advertising medium, we are informed that they have in hand at the moment schemes of external Christmas decoration involving a current consumption of some 1,865 amps. at 230 volts—420 units per hour! Surely enough to make some of our smaller-station engineers rub their eyes, the more so as this special illumination is to be kept in use for six weeks.

AN ELECTRICALLY-PROPELLED BATTLESHIP.

The U.S.S. "COLORADO."

By W. E. THAU, Marine Engineer, Westinghouse Electric and Manufacturing Co.

The four propellers of the new 33,000-ton United States battleship *Colorado* are electrically driven by directly connected, two-speed, wound secondary, induction motors, supplied with power by two turbo-generator sets. A battery of eight oil-fired, water-tube boilers supplies steam at 265 lb. gauge to the turbines. All engine-room auxiliaries necessary to the main propulsion, such as the main condenser circulating and condensate pumps, the auxiliary condenser condensate pumps, the lubricating and governor oil pumps, oil cooler circulating pumps, and the main motor ventilating blowers are electrically driven by direct-current motors, which are supplied, as well as the excitation of the main generators, by one of the three 300-kW geared turbine d.c. generating sets in each engine room.

The power generating machinery is located in two engine rooms, one being forward of the other, and both being forward of the control room. The turbo-generators are mounted directly above the condensers. On the same flat with the main generators are mounted two 300-kW geared turbine d.c. condensing and one non-condensing sets, all being of the three-wire type, supplying power at 240 and 120 volts. The condensers with their auxiliaries are mounted on the lower machinery flat or pump room. The switchboards for controlling the 300-kW sets are mounted at the ends of the engine rooms.

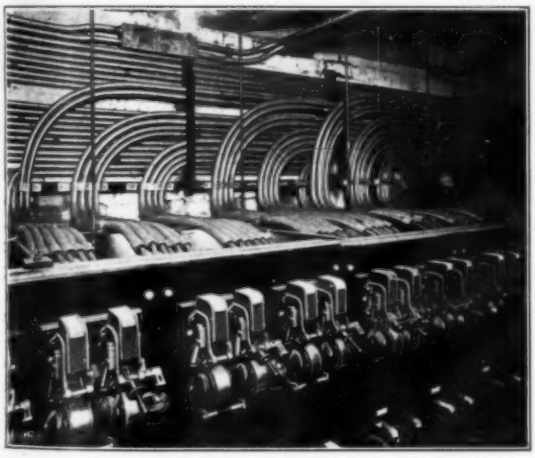


Fig. 7.—Portion of the Main Switchboard at Messrs. Lewis's, Manchester, showing the Conduit and Mains Approaching the Board. (See pp. 699-700.)

All control equipment and other apparatus necessary for the complete control of the propelling machinery is contained in the control room, located between the engine and motor rooms. The U.S.S. *Colorado* is the first turbo-electrically-driven vessel to have remote electric speed control. All operation incidental to the manœuvring of the main turbines, except the actual starting when preparing to get under way, is done electrically from the control room. This is a unique arrangement, in that it eliminates all mechanical and hydraulic connections between the turbines and the control station.

Each propelling motor, figs. 1 & 2, p. 702, is capable of delivering a maximum of 8,375 h.p. at a speed of approximately 185 r.p.m. The motors are of the induction type, and are wound for two speeds at full frequency, there being a 24-pole and a 36-pole winding. The stator has two independent windings, one for each set of poles. The rotor has a 3-phase, two parallel, star-connected winding, having balancer connections operating as such on the 24-pole winding. The latter is connected to three slip rings. When the stator is connected to the 36-pole winding the balancer connections form short-circuit paths for the rotor conductors, thus forming an ordinary squirrel-cage winding having straps instead of resistance rings to connect the rotor conductors together.

The design of the motors incorporates all special features required for marine service. The mechanical construction of the motor is of the self-contained type, in which the bearings are carried by suitable brackets which fit into recesses in the stator frame. The entire motor is supported by feet cast integrally with the frame on either side. The bearing housings are adjustable radially by means of jack screws in the brackets, and, after being adjusted, are bolted rigidly to the bracket. The ventilation is supplied by duplicate, direct-current, motor driven, exhaust blowers, each capable of delivering a maximum of 12,500 cu. ft. of air per minute. In addition, the rotor of the motor is provided with fan vanes to assist in the ventilation, which are capable of supplying sufficient air to enable the motor to operate for brief periods without the separate blowers. The separate blowers are mounted on top of the motors, and draw the air through the motors and discharge it through suitable ducts to the deck.

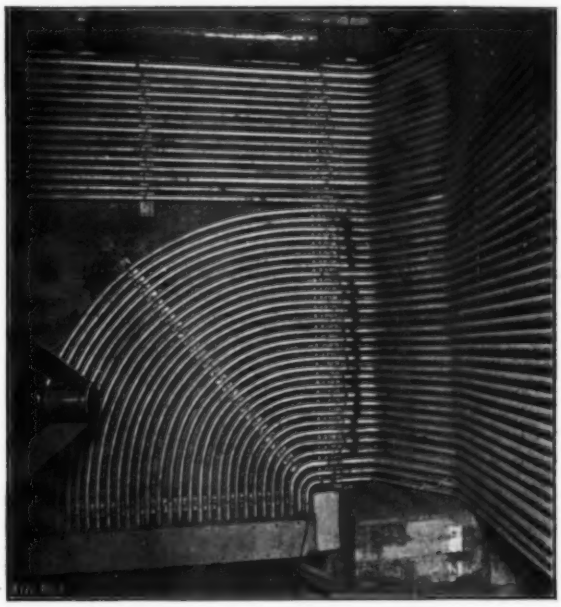


Fig. 8.—Tubing on its Way to the Main Switchboard. (See pp. 699-700.)

To facilitate inspection and repair, suitable tracks and disassembling gear are provided, which enable the stator to be moved clear of the rotor.

Each main generator is capable of delivering a maximum of 15,000 kVA, and is designed and constructed in accordance with standard land practice, except that the rotor is of the totally-enclosed type.

The air for ventilating the generators is supplied to the machinery space by means of separate blowers. The air is drawn from the lower machinery space through an inlet at the bottom of the generator, through the end bells, entering the machine at each end of the rotor, and is discharged through an outlet duct to the deck.

The rotor consists of a solid steel forging having radial slots for receiving the windings. The windings consists of a series of turns of bare copper strap and the

insulation is entirely mica and asbestos. After winding, the coils are very substantially braced, in order to prevent any possible movement.

The propelling motors and generators are provided with thermo-couples for measuring the hot-spot temperatures. The couples are connected to a central potentio-

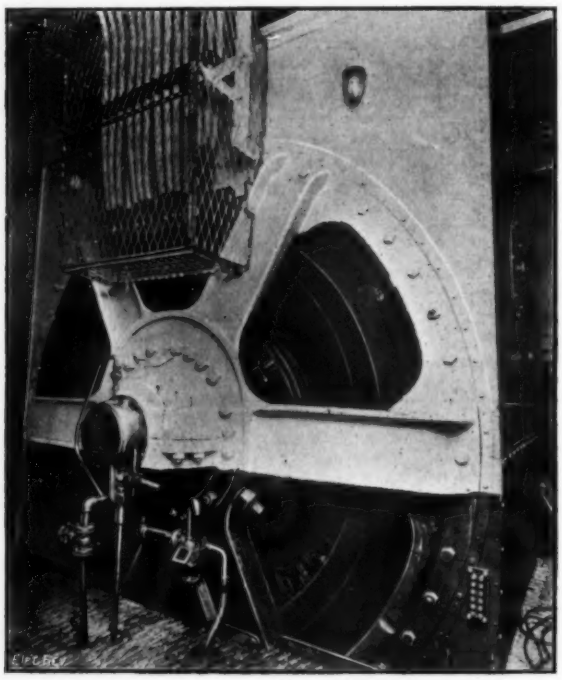


Fig. 1.—Main Propelling Motor of U.S.S. "Colorado."

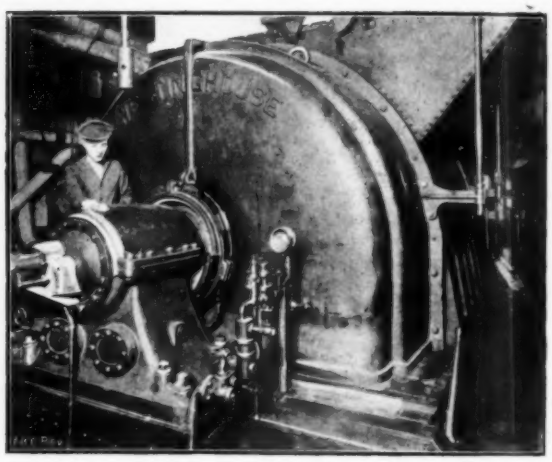


Fig. 2.—Main Propelling Motor.

meter board in the control room, where the readings may be recorded.

To prevent the motors and generators from sweating when idle, heaters are provided, the motors being heated electrically, and the generators by means of steam coils.

As in the case of any other drive, the control for the electric drive is operated under orders from the bridge. All controlling apparatus necessary for the operation of the propelling machines is either located in the control room, fig. 3, or arranged for remote operation from the control room, except the actual starting of the turbines when preparing to get under way. The main circuits are handled by means of manually-operated oil-immersed circuit-breakers. All circuit-breakers are of sufficient capacity to open the circuits under full power and full voltage, although in normal operation, the circuit-breakers are never opened or closed under load. The levers for the manual operation of the circuit-breakers are fixed directly in front of the control room instrument board, and are connected to the circuit-breaker operating mechanisms through a system of bell cranks and rods. The operating levers are interlocked to prevent improper operation. The primary circuit-breakers are in the control room and are arranged in two rows athwartship with an aisle between them for inspection and repair. The secondary short-circuiting breakers are in the motor rooms and are operated from the control room. The liquid rheostats for controlling the motor secondaries are placed in the control room. In order to disconnect circuits completely, self-contained disconnecting devices have been provided on the reverse and generator circuit-breakers. The mechanism is so arranged that the circuit-breaker must be opened before it is possible to disengage the disconnecting device. This provision safeguards the men in case of improper or faulty operation, and at the same time makes it possible to inspect or repair a circuit-breaker while the ship is under way.

The levers operate the circuit-breakers and rheostat valves in pairs, and are arranged in a single row, directly aft of the circuit-breaker structure. The arrangement is symmetrical so that levers on the left of the central position operate the circuit-breakers in the after generator and port motor circuits: those on the right of the central position operate the circuit-breakers which control the circuits of the forward generator and starboard motors. All the levers are mechanically interlocked so as to insure the proper sequence of operation. The scheme of interlocking is such that the field must be broken and the steam control reduced to a low setting before any of the circuit-breakers can be operated.

With two generators in operation the control of the port and of the starboard side of the ship is independent. With the tie circuit-breaker closed and one generator in operation, the direction of rotation of port and starboard screws may be in the same or opposite directions, but of necessity must be at equal speeds.

All starting and manœuvring are done with the twenty-four pole connection. When the motors are thus connected, the secondaries are controlled during starting and reversing by means of liquid rheostats. There is one double rheostat for the port motors and one for the starboard motors. The rheostat consists essentially of a

Fig. 3.—Control Room.

two-compartment tank, the lower compartment of which serves as a reservoir for the electrolyte, and also as a container for the cooling coils, while the upper compartment contains the electrodes. When it is desired to use a rheostat, the valve in the upper compartment is closed by means of a lever operated from the control stand, thus allowing the liquid to rise in the upper compartment. After the maximum level has been reached, the motor secondary is completely short-circuited by means of an oil circuit-breaker, which is operated by a lever from the control stand.

The generator field excitation is adjusted by means of a field lever in the control room, which controls the generator field of a motor generator booster set. The booster generator is connected in series with the generator field and functions to either boost or buck the 240 volts supplied by the auxiliary generator which furnishes excitation and auxiliary power. With this arrangement the required value of generator field excitation is obtained most economically.

The protection for the propelling machinery is provided by a detector system, which automatically indicates an earth and also the circuit in which the earth occurs, and by unbalanced phase relays which are arranged to trip out the generator field switch in case of any appreciable unbalance in the loadings of the different phases, which might be caused by earths, short circuits, or otherwise.

All of this electrical and steam apparatus was supplied by the Westinghouse Electric and Manufacturing Company.

RADIO NOTES.

France.—Radio Users' Union.—A French Union has been formed at a general meeting of experts, technicians, amateurs, and others interested in the development of radio-telegraphy and telephony. The Union's aim is to include in one important group all users of radio in order to defend their interests, to provide resources for research work, to make the new science better known, and to maintain France's present position in radio telegraphy and telephony.—*Evening News.*

Mexico.—Radio Broadcasting.—Broadcasting from a 500-watt station, installed by *El Universal* (a local newspaper), was inaugurated during the latter part of September.—*Commerce Reports.*

Radio-Broadcasting. — Transmission Tests.—During the early hours of Monday, November 26th, the British Broadcasting Co. is to make an experimental transmission solely for the amateurs of the United States. At 3 a.m. all the eight stations of the company will be linked by an automatic relaying system, and the programme from the London station will be sent out simultaneously from all. After a short interval each station will send out a programme on its own wavelength. If cable messages indicate success, the experiment will be repeated on the night of November 27th-28th. It is reported that 2 LO, the London station, has been heard in Cairo, Egypt.—*Daily Mail.*

Radio Circuits for Experimenters.—New Handbook.—A novel type of handbook, entitled "Building with Radio Brix," has been sent us for review by the producers, the Metropolitan-Vickers Electrical Co., Ltd. It contains diagrams of 46 circuits, with explanations and comments, and illustrations showing how they can be made up from "Radiobrix"—the M.V. radio units, each complete in itself, of which nine forms have been developed (but it is pointed out that the diagrams are suitable for use with any make of radio apparatus). Facing each page of diagrams is a page of squared paper for notes, which will be found most useful by experimenters; the practice of note-keeping is indispensable to successful progress in this fascinating pursuit, but detached notes in an ordinary notebook are difficult of reference and thus lose much of their value. Provision has been made for inserting additional diagrams in the book as they are issued from time to time, interleaves of squared paper being provided in this section also. The diagrams are graduated from the most simple crystal circuit to those employing three or four valves, and we are pleased to see that to circuits which must not be used for British broadcasting on account of their liability to cause interference with other listeners' comfort special warning marks are attached. A prefatory section explains general principles and draws attention to the importance of such matters as correct lay-out of apparatus and wiring, accurate tuning, oscillation, &c. The handbook, which will be on sale at the Wireless Exhibition, price 1s., will certainly be welcomed by listeners who are disposed to experiment with different circuits.

South Africa.—Radio-Broadcasting.—As the result of an offer made by Sir David Graaff to present Cape Town with a 6-kilowatt broadcasting station, together with all accessories, a special committee of the Council is now considering a scheme of municipal broadcasting. The Council is anxious to reserve for itself the privilege of broadcasting for a period of 15 years. The equipment for the station will be furnished by the Marconi Co., of England, which will also supply the technical assistance to supervise its operation. With the exception of experiments made by newspapers, the Cape Town station will be the first permanent venture of its kind in South Africa. The Postmaster-General of the Union of South Africa has issued comprehensive regulations governing broadcasting in the Union.—*Commerce Reports.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review in which the "Official Notice" appeared in our advertisement pages.)

OPEN.

Australia.—Sydney.—City Council. January 7th. Coal-unloading and conveying plant.*

January 14th. 33,000-V step-up transformer.*

Melbourne.—January 3rd. Victorian Electricity Commissioners. Aluminium steel-cored cable and accessories. (October 26th.)

January 19th. Sub-station transformers, switchgear, and accessories. (October 26th.)

November 20th. Postmaster-General's Department. Telephone apparatus.*

December 19th. Victorian Railway Commissioners. Fibre for insulators.

Belfast. — November 19th. Electricity Department. Steam, water, and other piping, &c., at the Harbour power station. (November 2nd.)

December 18th. Board of Guardians invite schemes for the installation and equipment of a centralised heating and lighting plant. (See this issue.)

Belgium.—Liege.—January 5th, 1924. Liége Provincial Government authorities. Establishment of an electricity distribution system in the commune of Chenée, together with the necessary transformer boxes.

November 23rd. Municipal authorities of Ville-Pommerœul (Province of Hainaut). Overhauling the electricity distribution system in the town.

Antwerp.—January 11th. Electrical installation at the new Sainte-Anne Hospice. Particulars (30 fr.) from the Hospices Civils, 93, Rue de la Paix, Berchem-Anvers.

Ghent.—November 17th. Municipal authorities. Eight electric cranes at the Ghent docks.

Birmingham.—November 21st. Public Works Committee. Construction of 700 yards double-track tramway and about 3,000 yards of wooden-sleeper construction double-track tramway in Bristol Road and Lickey Road. Mr. H. H. Humphreys, city engineer, Council House, Birmingham.

Bradford. — November 17th. Tramways Committee. Stores for 12 months. Mr. R. H. Wilkinson, general manager, 7, Hall Ings.

Dublin.—November 12th. Great Northern Railway (Ireland). Stores, including electrical fittings, lamps, cable and wire, &c., for six months. (October 26th.)

November 19th. Dublin United Tramways Co. (1896), Ltd. Stores for six months, including electric lamps, electrical fittings, &c. (See this issue.)

Dundee.—Stall Holders' Association. For the laying of electric cable for market lighting purposes; also for four portable iron standards, 12 ft. high, for distribution boxes. Specifications from Mr. A. Douglas, 77, Overgate, Greenmarket Stallholders' Association, Dundee.

November 22nd. Electricity Department. Single- and three-core l.p. paper-insulated lead-sheathed cable. (See this issue.)

Edinburgh.—November 19th. Electricity Supply Department. Five 3-phase transformers. (See this issue.)

Egypt.—Alexandria.—November 15th. Postal Administration. Stores, including lamps, &c.*

Finland.—Helsingfors.—November 22nd. Finnish Ministry of War. 10,000 kg. h.d. tinned-steel wire for field telephones.*

Glasgow.—Committee on Cleansing is inviting tenders for the construction of the proposed new refuse destructor works at Govan.

Hastings. — Electricity Department. Water-softening plant. (October 26th.)

Hawick.—November 12th. Roxburgh County Education Authority. Electric lighting installation at Hawick High School. Mr. W. A. Edward, executive officer, Education Offices, Newton Street, Boswells.

Hull.—November 12th. Tramways Committee. Supply of coal. Specifications, &c., from Mr. E. S. Rayner, engineer and general manager.

Keynsham.—November 12th. Board of Guardians. Electric lighting installation. Mr. Chas. Martin, clerk.

London.—PADDINGTON.—November 23rd. G.W. Railway. Stores, including telegraph instruments, cables, wires, lamps, apparatus, &c. (November 2nd.)

INDIA STORE DEPARTMENT.—November 29th. Switchboard cable and v.i.r. insulated wire. (See this issue.)

Manchester.—November 13th. Tramways Committee. Single-deck motor-'buses; tramcar trucks; tramcar motors; surfacing and screw-cutting lathe, 6 in. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

Newcastle-under-Lyme.—November 20th. Electricity Department. 500 yd. .10, .04, .10 single l.p. paper-insulated lead-covered steel-armoured distributor. (See this issue.)

New Zealand.—AUCKLAND.—November 24th. Electric Power Board. Transformers and accessories.*

Preston.—November 26th. Electricity Department. Two 150-kW rotary converter equipments, h.p. and l.p. switchgear, h.p. cables. (November 2nd.)

Reigate.—November 21st. Town Council. Electrically-driven drainage pumps. (See this issue.)

South Africa.—JOHANNESBURG.—Municipal Council. November 19th. Electric cables.*

December 10th. South African Railways and Harbours Blockyard plant, Table Bay Harbour Breakwater extension, 3 electrically-driven concrete mixers, 2 electrically-driven stone elevators, 2 electrically-driven sand elevators, 1 electric lift for cement, &c. Particulars from High Commissioners of the Union of South Africa, Trafalgar Square, W.C.—*S. A. Mining and Engineering Journal.*

CAPE TOWN.—November 29th. City Council. Transformers.*

GRAAF REINET.—December 20th. Municipal Council. Crude oil engines, generators, and street equipment. Specifications and particulars from the Town Clerk, Town Office, Graaf-Reinet, on deposit of the sum of £5 5s., which will be refunded on receipt of a *bonâ-fide* tender.—*Reuter's Trade Service* (Cape Town).

Uruguay.—MONTEVIDEO.—December 27th. State Electric Light Works. Electrical supplies, including cable, insulating compound, lamp shades, &c.*

Warrington.—November 19th. Electricity Department. M.P. paper and lead-covered cables and M.P. rubber-covered cables. (See this issue.)

November 20th. Cheshire Lines Committee. Stores, including telegraph materials, for 12 months. Stores Superintendent, Cheshire Lines, Warrington.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—MELBOURNE.—The Amalgamated Wireless (Australasia), Ltd., in which the Commonwealth Government holds a large interest, has accepted the tender of Marconi's Wireless Telegraph Co., of London, at £487,000, to erect a high power station in Australia. A site has not yet been decided upon. The Marconi Co. will erect corresponding stations in Great Britain and Canada.—*Tenders.*

Bath.—Town Council. Accepted:—

No. 2 Brush-Ljungstrom turbo-generator set and incidental plant (£21,142).—Brush Electrical Engineering Co., Ltd.

Rotary converter, motor transformer, &c. (£1,477).—Mather & Platt, Ltd. Switchgear, &c. (£491).—Ferguson, Pailin, Ltd.

Belgium.—Belgian Post and Telegraph Authorities. Accepted:—

Supply and laying of the telephone cables covered by Items 1 and 2 of Specification No. 735, the total amount of the contract being approximately 1,200,000 Belgian francs.—Ateliers de Constructions Electriques de Charleroi.

Bradford.—Corporation Electricity Committee. Recommended:—

Condensing apparatus for 20,000-kW generator.—Cole, Marchent & Morley.

Canterbury.—Town Council. Accepted:—

Apparatus for direct telephonic intercommunication between the police and fire stations.—Mr. S. W. Bligh.

Dublin.—Housing Committee.

The Committee has received the following six tenders for the electric wiring of the 84 houses at present in course of construction on the Donnelly's Orchard housing area, viz.:—

C. Jones, Jun., Ltd. (not to specification)	£743
A. Burton	1,046
Roche & Magennis. (Recommended.)	1,046
J. Ryder	1,140
G. Morrison	1,346
Dublin Corporation Electricity Department	1,975

The City Electrical Engineer, in analysing the quotations, explained to the Committee that his department's tender was based on the payment of 3½d. per hour extra to their electricians over and above the current outside rate. This fact precluded him from recommending the acceptance of his department's tender.

Electricity Committee.

Thirteen tenders, ranging from £212 to £392, were received for a hand-operated gantry, fitted with roller bearings. The lowest quotation was that of Messrs. Wharton, Ltd., whose price £212) includes the sum of £30 for contingencies. This tender is recommended for acceptance.—*Irish Builder and Engineer.*

Glasgow.—Corporation. Accepted:—

Electric lighting installation at the Portugal Street lodging-house (£143).—J. B. & J. A. Matheson, Ltd.

Tramways Committee. Recommended:—

Carborundum blocks.—W. Gray & Co.; Wilson, Feather & Co.; C. Churchill & Co., Ltd.

Patent anchors (Carey's).—Bolckow, Vaughan & Co., Ltd.

Rail joints.—Thermit, Ltd.

Brass tubing.—P. & W. MacLellan, Ltd.

Halifax.—Board of Guardians (Hospital Committee). Accepted:—

Electric light fittings in matron's and doctor's rooms, lecture hall, and nurses' dining-room, &c.—F. S. Jackson, Halifax.

Hawkington.—Accepted:—

Installing the electric lighting at the Village Hall.—B. E. Stookes & Co.

Irish Free State.—ENNIS (CO. CLARE).—Clare Mental Hospital Committee. Accepted:—

Electric lighting installation.—Messrs. Maguire.

London.—GOVERNMENT CONTRACTS.—General Post Office.—An order for telephone exchanges, estimated to cost between one and two million pounds, has been placed with the Automatic Telephone Manufacturing Co., Ltd., of Liverpool, for the provision of the first exchanges for the London automatic telephone system, which will provide for 58,000 subscribers. This will be the first installation of the automatic system in the metropolis. The contract stipulates that 95 per cent. of all the materials entering into the composition shall be British products, and all the labour engaged on the work must be British. The work will be spread over three or four years.—*Daily Dispatch.*

Post Office. Stores Department.

12 months' supply of "Cosmos" vacuum lamps.—Metropolitan-Vickers Electrical Co., Ltd.

H.M. Office of Works.

"Cosmos" vacuum lamps for a period of nine months (part of contract).—Metropolitan-Vickers Electrical Co., Ltd.

LONDON COUNTY COUNCIL.—Highways Committee. Accepted:—

Pipework and de-aerating plant, Greenwich power station (£3,408).—G. and J. Weir, Ltd.

Nelson.—Town Council. Accepted:—

6,000-kW turbo-generator plant, with condensing plant, air rejector, water-extraction pump, motor and control gear for pumps, air filter, &c.—Brush Electrical Engineering Co., Ltd.

One 250-kW invertible rotary-converting set, complete with e.h.p. and l.p. control, panels, &c.—Metropolitan-Vickers Electrical Co., Ltd.

H.p. switchgear extensions.—Metropolitan-Vickers Electrical Co., Ltd.

One water-tube boiler, 200 lb. super heat, with economiser, chain-grate stoker, &c.—Babcock & Wilcox, Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (North-Eastern Centre).—Monday, November 12th. At Armstrong College, Newcastle-on-Tyne. At 7.30 p.m. Ordinary meeting.

(North-Midland Centre).—Tuesday, November 13th. Opening meeting. Chairman's (Major Bell) address and smoking concert.

(Scottish Centre).—Tuesday, November 13th. At Glasgow. Inaugural address, by the Chairman, Mr. R. B. Mitchell.

(Irish Centre).—Thursday, November 15th. At Dublin. Lecture on "Modern X-ray Equipment and Practice," by Mr. P. G. Griffiths.

(South-Midland Centre).—Wednesday, November 14th. At the University, Birmingham. At 7 p.m. Paper on "Technical Research, with Special Reference to Electrical Engineering Development," by Mr. W. Wilson.

(London Students' Section).—Friday, November 16th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Lecture on "The De Forest Talking Film," by Mr. C. F. Elwell.

(Scottish Students' Section).—Friday, November 16th. At the Royal Technical College, Glasgow. At 7.30 p.m. Chairman's (Mr. J. F. Nielson) inaugural address.

Northampton Engineering College Engineering Society.—Monday, November 12th. At the College, St. John Street, E.C.1. At 5.30 p.m. Paper on "Turbo-Compressors and Blowers," by Mr. A. J. D. Humby.

Electrical Society of Glasgow.—Tuesday, November 13th. At Glasgow. Paper on "Illumination," by E. J. Taylor.

Illuminating Engineering Society.—Tuesday, November 13th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Opening meeting. "Presentation of Reports on Progress during the Vacation and Developments in Lamps and Lighting Appliances."

National Association of Supervising Electricians.—Tuesday, November 13th. At St. Bride's Institute, Ludgate Circus, E.C. At 6.45 p.m. Lecture on "V.I.R. Cable: Its Manufacture and Selection," by Mr. W. Lang.

Royal Society of Arts.—Wednesday, November 14th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "The Electric Transmission and Reproduction of Writing, Designs, and Photographs Without Wires," by M. Edouard Belin.

Engineers' Club.—Wednesday, November 14th. At Coventry Street, W. At 12 noon. Annual general meeting.

Society of Technical Engineers (Manchester District).—Wednesday, November 14th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Discussion on "The Function of the Staff Council in Industry."

Electrical Trades Benevolent Institution.—Wednesday, November 14th. At the Trocadero Restaurant, W. At 7.30 p.m. Festival dinner.

Belfast Association of Engineers.—Thursday, November 15th. At the Municipal College of Technology. At 7.30 p.m. Paper on "Automatic Telephones," by Mr. G. A. Hollings.

Belfast Association of Engineers.—Thursday, November 15th. At the Connaught Rooms, Great Queen Street, W.C. At 7 p.m. for 7.30 p.m. Annual dinner.

British Electrical Development Association.—Salesmanship Conference.—Friday, November 16th. At St. Bride's Institute, E.C. At 7.30 p.m. Paper on "How to Sell Heat and Problems Related to the Warming of Air and Body," by Mr. A. F. Berry.

Edinburgh Electrical Society.—Friday, November 16th. At the Philosophical Institute, 4, Queen Street. At 8 p.m. Talks on "Apprenticeship," by Mr. D. P. Gilchrist.

Junior Institution of Engineers.—Friday, November 16th. At 39, Victoria Street, S.W. At 7.30 p.m. Annual general meeting.

Institution of the Rubber Industry.—Friday, November 16th. At the Hotel Victoria. Second annual dinner and meeting.

Institution of Mechanical Engineers.—Friday, November 16th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "The Possibilities of Mercury as a Working Substance for Binary Fluid Turbines," by Mr. W. J. Kearton.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Requests for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the names and addresses of the makers of:—

Reversing switches (not tumbler type) for fractional horse-power motors.

Glass enclosed vacuum-type mercury switches (10 amp.) as used in arc lamps.

Bakelite in powder.

A fuse carrier (porcelain, 200 amp., 500 V) with initials VW on handle.

NOTES.

Accident.—While cutting an electric cable with a pair of pliers, John Taylor, aged 45, a Manchester Corporation cable jointer, was badly burnt about the head, face, and hands. He lies in Manchester Royal Infirmary in a serious condition. —*Daily Dispatch.*

Service Notes.—The Admiralty has notified that with regard to the decisions of the Welfare Conference, Group 1, Class Request No. 50 (a), the instruction to cover the necessary ground has been included in both 12 weeks' qualifying courses, namely—telegraphist for leading telegraphist and leading telegraphist for petty officer telegraphist, but only men within two years of leaving the service may sit for the Postmaster-General's certificate. Additional officers who served with electrical units in the war have been posted to the reserve of officers.

Cynwyd Hydro-electric Station.—In connection with the description of the above installation elsewhere in this issue, it is pointed out that the small alternator generates a pressure of 400 volts, not 220, and that the smaller transmission-line terminal transformer is of 45 kVA, not 25, as stated.

Concert.—A large audience assembled in the Cripplegate Theatre on Saturday last for a concert arranged by the County of London Electric Supply Co., Ltd., Social Society. Owing to illness, Sir Harry Renwick, K.B.E., president of the Society, was unable to be present. The first part of the programme was provided by the "Clesco" Concert Party—"The Motleys"—under the direction of Mr. W. E. Dossett. The second half of the programme concluded with the one-act play "That Brute Simmons."

Exide Batteries.—The Exide service organisation is being constantly extended; a representative has recently returned to England from a tour in the East, chiefly in British territory, where he has established new agencies and depôts. There are now nearly 400 Exide service agents in this country; there are about 1,000 in the British Empire, and altogether throughout the world over 6,000. At a luncheon the other day, Mr. Gordon England, the well-known racing motorist, who uses such batteries for racing purposes, mentioned that coil ignition was coming more into use. In reducing the price of Exide batteries their makers have passed on to the public economies that have been made in the cost of production as a result of increased output, and it is gratifying to be able to record that the Chloride works have recently been extended and the number of employés increased by 10 per cent.

A Railway Signalling Device.—Reduction in the number of signal boxes, their staffs, and the cost of upkeep in isolated parts of long railway lines is promised by a new system of working the points from a distant signal cabin by a telegraph signal which actuates an electrical relay near the points, and the relay on responding automatically switches in a heavy current from a battery which operates the points. The points having been switched over, a return signal, also automatic, announces to the signalman that they are correctly placed. By means of an additional device the signal cannot be set at "clear" until the points have been switched over to the right line. An installation of this kind has been placed at Ashington, Northumberland, and an experimental one has been for some time in successful operation in one of the big stations in London.—*Daily Mail.*

The Graphical Calculation of Overhead Electric Power-Transmission Lines.—In a paper about to be published by the Institution of Civil Engineers, Mr. W. T. Taylor, M.Inst.C.E., recites briefly the principal electrical characteristics occurring in a bare overhead electric power transmission line, and gives a diagram showing the relation between the various elements in a power transmission line when the effect of capacity and leakage is not taken into account. A graphical calculation is given for bare overhead electric power transmission lines, which includes lines operating over the longest distance and at the highest voltage in this country at the present time. The graphical calculation (plotted to logarithmic scale) has for its basis the formula:—

$$e' = \text{R} \cos\phi + \text{X} \sin\phi.$$

where e' denotes the voltage-drop per mile per ampere.

In a transmission line the voltage, power, and power-factor are theoretically varying along the line, and the variation depends on the fundamental line-constants and on the amount and nature of the load. The loss is variable according to the change of load, and the total loss of energy in a kilowatt-year is dependent on the load-factor. The voltage regulation is greatly impaired by a low power-factor. When the power-factor is very high the line-current is almost in phase with the receiver-voltage, and the value of IR largely settles the voltage-drop e; but when the power-factor ($\cos\phi$) is low—a condition commonly met with in practice—IX becomes the predominating factor. The line-current is theoretically varying along the conductor owing to the charging-current, but this charging-current for the lines under consideration is usually very small compared with the full-load current or the estimated average-load current.

The alternating-current overhead power lines under consideration are those designed for operation at a maximum of, or preferably below, 50,000 volts, a frequency of 50 cycles per sec., a transmission length of 50 miles, and a lagging power-factor.

The following practical advantages result from the application of this graphical calculation:—

Since the conductor values are based on the diameter of the conductor, the chart should be of international utility; as standards change from time to time, the chart has a permanent value, because it is not affected by a change of standard sizes of conductor; intermediate or any spacing of line conductors can be visualised at a glance; the bad effect of power-factor can be visualised at a glance; a table of sines and cosines is not required; the effect of frequency is shown; a table of ohmic resistance values is not required; there is no necessity to calculate for inductive reactance for any frequency. The chart should be of great value in checking calculations made by the more exact method. By means of the chart voltage-drop calculations are simplified, the results being sufficiently accurate for all practical purposes.

The Electro-Harmonic Society.—At the concert (Ladies' Night), to be held in the Caxton Hall, Westminster, to-night, Dr. Alexander Russell, M.A., president of the Institution of Electrical Engineers, will take the chair. The artistes will be as follows: Miss Alice Lilley, soprano; Miss Barbara Samuel, contralto; Mr. David Evans, baritone; Miss Evelyn May, violin; Mademoiselle Marbarella, violoncello; Mr. Wilson James, humorist; Mr. Nelson Jackson, entertainer; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

New Electrical Motor in America.—The announcement made by Mr. A. H. Timmerman at the convention in Omaha of the National Electric Light Association of the invention and perfection of a new alternating-current electric motor was confirmed here recently by Mr. W. A. Layman, president of the Wagner Electric Corporation, St. Louis, of which Mr. Timmerman is vice-president. The motor is known as the Fynn-Weichsel, being the invention and design of Mr. Val. A. Fynn and Mr. Hans Weichsel. The Wagner Co. has spent years in experimenting and developing the motor, the commercial practicability of which has been tested. It is claimed that the motor will make possible an increase of from 30 to 50 per cent. in the amount of electric power derived from the same central station investment.—*Reuter's Trade Service* (St. Louis).

Eric Gérard Memorial.—To perpetuate the memory of Prof. Eric Gérard, whose work largely contributed to the high reputation of the University of Liége, an international committee has been formed (on which Sir Philip Dawson represents this country) and has opened a subscription for a memorial tablet to be fixed in the auditorium of the Institut Montefiore. Any surplus funds will be applied to found an Eric Gérard prize for important electrotechnical works. Contributions should be sent to M. Maurice L'Hoest, treasurer of the Executive Committee, 5, Place du Parc, Liége, Belgium. A subscription of 25 fr. or more entitles the donor to a copy of the *Liber Memorialis*, and 50 fr. to a miniature replica of the medallion.

Lectures.—Miners' Nystagmus.—Mr. T. Bryson, lecturer at the Wigan Mining and Technical College, addressing a miners' meeting at Barnsley last week, said that the incidence of nystagmus in collieries where electric hand-lamps were in use had steadily decreased. He thought that the lamp of the future would be worn on the cap and designed to detect 2½ per cent. of inflammable gas.

The New Tivoli Kinema.—The warming and ventilating installation at the new Tivoli Kinema, described on p. 663 of our last issue, was carried out by Messrs. Henry Hargreaves and Sons, of Bury, Lancs.—not of Bolton, as stated in the article.

In the preparation of the scheme of illumination for this theatre, which presented specially difficult problems, the Illuminating Engineering Department of the General Electric Co., Ltd., took an important part, and was largely responsible for the very successful results that were achieved.

Fatalities.—"Death following contact with an electric current, caused by a defective lamp" was the verdict at an inquest in Dublin, on Peter Clarke, a fitter, of Widnes. Deceased was fitting a new furnace grate in Jameson's Distillery, Bow Lane, and had been given a lamp which, the Inspector of Factories (Mr. Shannon) said, was not of the regular pattern, although there were plenty of safety lamps available. The jury held that proper supervision had not been exercised. Clarke was in the employment of a Glasgow firm.

G. C. Lloyd, aged 13, was killed in the basement of the Coronet Kinema, Cathays, Cardiff, on October 25th, by receiving a shock from a flexible electric lighting wire which caught him under the chin as he passed through a door.

A fatality at the Manchester Corporation electricity works, Stuart Street, on Sunday last, was the subject of an inquest on Tuesday, by Mr. Surridge, coroner. The deceased, Thomas Ashton Sutton (36), had been employed at the works as a labourer since he was 17 years of age. Henry Discon, dynamo tender, stated that he and Sutton were standing on a table in the switchboard basement cleaning parts of the high-pressure equipment, enclosed in cubicles. Witness had turned round to pick a lamp up when he saw a blue flash. Sutton shouted, fell off the table, and died almost immediately.

W. E. Plowman, turbine house superintendent, said Sutton had been cleaning a number of cubicles, which had been made "dead." Six had been opened and closed in witness's presence, but the one in which the accident happened was not among them, and witness had not given orders for it to be opened. He thought deceased might have opened it thinking it was dead. He had never known a workman to open one without instructions.

The Coroner said there was no doubt that deceased died as the result of receiving a very severe electrical shock from touching some live part of the apparatus. He was satisfied that the plant and apparatus was in perfect order. The accident had arisen, he thought, through some misapprehension on the part of Sutton.

A verdict of "Accidental Death" was returned.

Local Societies.—Industrial Illumination.—Mr. Geo. Herbert read a paper on the above subject before the Edinburgh Electrical Society, on November 2nd, in the course of which he said that in a large number of typical works the cost of lighting formed less than one per cent. of the wages bill, and a still smaller fraction of the total operating costs. Actual figures determined by experience showed that correct lighting meant 12 per cent. increase in production, 25 per cent. decrease in spoilage, and 25 per cent. in preventable accidents. Direct lighting was recommended on account of its low cost and high efficiency, as compared with indirect lighting, which should only be used in particular cases where special illumination was necessary on account of the nature of the work being done.

Oscillatory Currents.—Under the auspices of the Widnes and District Scientific Society, Mr. E. M. Hollingsworth, electrical engineer to the United Alkali Co., Ltd., and chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, recently lectured on "Oscillatory Currents." He described the equipment of a radio broadcasting station, and in the latter part of the lecture dealt with the application of heavy current electricity, with special reference to extra-high-voltage alternating-current transmission.

Radio-Signalling.—Under the auspices of the Ulster Public Officers' Association, Mr. Rupert Stanley, M.I.E.E., principal of the Municipal College of Technology, delivered a lecture recently on the development of radio-signalling. There was a large attendance, and practical experiments were carried out.

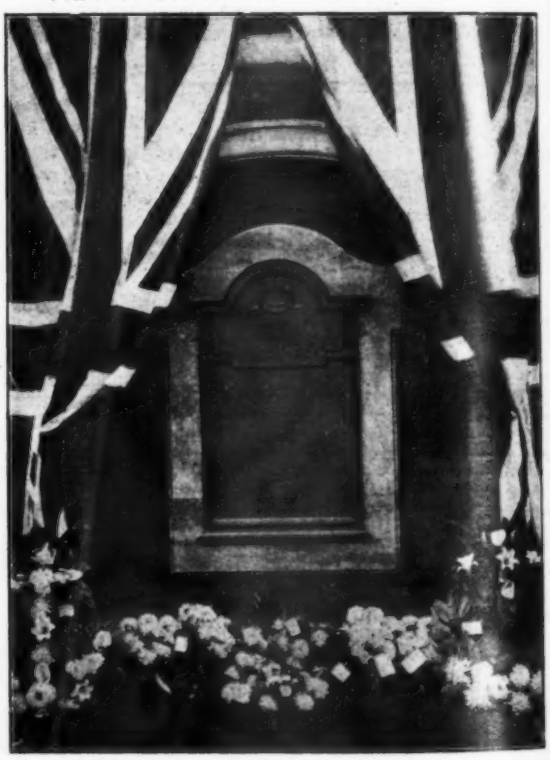
Surges and Lightning Protection.—At a meeting of the North of England Branch of the Association of Mining Electrical Engineers, held in Newcastle-on-Tyne on November 3rd, Prof. W. M. Thornton lectured upon electrical surges and lightning protection. The pressure between a cloud and earth might easily reach 100,000,000 volts, and the energy of a lightning flash might reach 50,000,000 ft.-lbs., and this discharging in 1-10,000th of a second would be at the rate of 800,000,000 h.p., giving a transient wireless surge far beyond the reach of man.

Dr Thornton showed some slides of lightning flashes of the various well-known types, and explained measures taken to protect electrical installations against damage by lightning or surge. Lastly, he dealt with the singular phenomenon of ball lightning, which Dr. Thornton said was probably nothing else than a sphere of electrically active ozone with some nitrogen compounds in a state of rapid re-combination or reversion to oxygen. It contained immense chemical or physical energy which was liberated instantly when the ball touched water or was reduced to an unstable state. It was not lightning at all, but a state of electrified matter produced by the same process as was the lightning flash, but just falling short of the requisite intensity. It was the same in nature as St. Elmo's fire seen at the mastheads of ships or at yard ends when at sea.

In Memory of Those Who Fought and Fell.—A bronze tablet perpetuating the memory of the Callender men who fell in the Great War was unveiled at the Anchor Works, Leigh, on Friday last, in the presence of a large gathering of the firm's employés and relatives of the fallen.

The directors and management of the company were well represented, amongst those present being: Sir J. Fortescue Flannery, Bart., Sir Tom Callender, Sir Ernest William Moir, Bart., Sir John Malcolm Fraser, Bart., Messrs. Th. Petersen, C. Pipkin, H. Foulds, and J. Bowyer.

The end of one of the existing buildings was rebuilt on suitable lines to accommodate the Memorial Tablet, which is cast bronze, mounted on a grey marble base. The tablet was unveiled by Gunner Hampson—a severely disabled ex-service man employed at the Anchor Works—and the memorial was then dedicated by the Rev. L. S. Murdoch, M.A., Vicar of Christ Church, Leigh. The Rev. A. Wood (Leigh Wesleyans) read appropriate passages of Scripture, and the Rev. Father Fitzgerald (St. Joseph's) represented the Roman



Memorial Tablet at Anchor Works, Leigh.

Catholic community. In an address prior to the unveiling, Sir Tom Callender said the men whose names were on the tablet had rendered most noble service to their country. They were not likely to be forgotten, but it was felt that what they had done in a time of great stress and danger should be suitably commemorated. The tablet was but a small thing to represent great and noble deeds, but it was so placed that whenever the workpeople passed into the factory they would be able to look up and remember their fallen comrades with the deepest respect and admiration.

Sir J. Fortescue Flannery, Bart., after paying tribute to the great part played by Lancashire during the war, said the town of Leigh did its share and did it well. They at the Anchor Works, as part of that town, contributed in proportion to their numbers, both in manufacture and in the fighting line. They turned out large quantities of Admiralty cables, field telephone cables, aircraft cables, and towing cables for sweeping up enemy submarines. Of field telephone cables alone no less than 117,000 miles was turned out from the Anchor Works, and in addition 260 men went into the fighting line. Their record was one of which they were justly proud.

Appointments Vacant.—Assistant divisional engineers in the Posts and Telegraphs Department of the Government of India. (See our advertisement pages.)

Invisible Metal Wire.—Scientists at the Bell System Laboratories of the Western Electric Co. have found it possible to make gossamer-like metallic strands as fine as 200-millionths of an inch in diameter. These copper-nickel wires are being used in the construction of the vacuum thermocouple. Practically invisible to the eye as they are, it is found necessary to weld them together under the microscope for enclosure within the minute vacuum bulbs.

Thermocouples are required to adjust circuits in the vacuum-tube repeaters on long-distance telephone lines. In general these tiny glass bulbs are used to measure the small alternating currents in telephony and radio. The wires made up from a copper-nickel alloy used in fuses to protect the thermocouples are passed through an electrolytic acid bath, where they are eaten down to the size desired, it being impracticable to draw wire through dies as fine as is necessary.

Both copper-nickel and tungsten wires are used in this laboratory. The tungsten threads are the smallest of all, being only 200-millionths of an inch thick—a good one hundred of them would be required to make one wire the size of a human hair.

Before the development of the electrolytic process, it was exceedingly difficult and expensive to draw the tungsten wire to sizes less than 500 hundred-thousandths of an inch in the laboratory. This wire, which the eye can hardly discover even under strong light with the aid of a microscope, can be produced easily.—*Science Service.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—At the meeting of the Institution on the 1st inst., the president, Dr. A. Russell, announced that Col. R. E. B. Crompton, C.B., a past president, had been elected an hon. member. He also referred to the deaths of M. Maurice Leblanc and Dr. C. P. Steinmetz, and asked the members to stand in silence; telegrams of condolence were sent to both the French and American Institutions of Electrical Engineers.

Irish Centre.—The Irish Centre of the Institution met in session last week in Dublin. The officers for the ensuing year are:—*Chairman*: Mr. R. N. Tweedy; *Vice-Chairman*: Mr. C. P. Coote Cummins; *Committee*: Messrs. R. G. Allen, A. G. Bruty, R. M. Eaton, A. J. Orr, E. C. Handcock, G. M. Harris, J. A. Kenny, J. H. Shaw, S. T. Robinson, F. G. Sherwood; with Mr. F. W. Parkes as hon. treasurer, and Mr. W. Tatlow as hon. secretary.

North-Western Centre.—The opening meeting of the above Centre took place at Manchester on the 6th inst., when the chairman, Mr. G. A. Juhlin, delivered his address. Discussing the factors conducive to the rapid strides made by electrical engineering in America, he said that a very prominent one was that utility was the keynote of all work; super-excellence was not looked for or considered worth paying for. The year had been remarkable for the demand for electrical plant in the U.S.A. While in this country they were in many respects behind in electrical development, the leeway was gradually being made less.—*Manchester Guardian.*

Western Centre.—The 57th ordinary meeting of the Western Centre was held at Bristol on November 5th, when the chairman (Mr. C. T. Allan) presided over a large attendance of members and visitors. The hon. treasurer (Mr. A. J. Newman) presented the statement of accounts for the previous session, which showed a balance on the right side of £70. After routine business had been transacted, Prof. David Robertson lectured on "The Mariner's Compass." Models of various instruments and a series of fine lantern slides enabled the lecture to be followed with sustained interest throughout.

Röntgen Society.—The Structure of the Atom.—In his presidential address on Tuesday last, Sir Oilver Lodge dealt with the influence of X-ray research and the study of radioactivity on our knowledge of the structure of the atom, and elaborated a theory regarding the nature of the nucleus and of the electron.

Faraday Society.—Electrode Reactions and Equilibria.—A general discussion on this subject has been arranged by the Faraday Society meeting at the Institution of Electrical Engineers on November 26th next. The first session of the meeting will extend from 3 to 5 p.m., and will deal with "Conditions of Equilibrium at Reversible Electrodes." Sir Robert Robertson, president, will preside, and the introductory address will be given by Dr. E. K. Rideal. Among the speakers will be Prof. Bjilman, of Copenhagen, who will read a paper on "Some Oxidation and Reduction Electrodes and their Importance to Organic Chemistry." After an interval for tea, the meeting will resume at 5.30 p.m., and will devote itself to the consideration of "Irreversible Electrode Effects, including Passivity and Overvoltage." Prof. F. G. Donnan, vice-president, will preside over this session, and the introductory address will be given by Prof. A. J. Allmand. At the conclusion of the meeting there will be a dinner at the Holborn Restaurant, to be followed by an informal conference. Members of the Chemical Society, the Physical Society, and the Institution of Electrical Engineers have been invited to attend this discussion. Others interested should apply to the secretary of the Faraday Society, 10, Essex Street, London, W.C.2, from whom a full programme may be obtained.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. R. B. Mitchell, who is chairman of the Scottish Centre of the Institution of Electrical Engineers for the 1923-24 session, has been connected with Glasgow all his life. He was educated at Allan Glen's School, the Royal Technical College, and Anderson's College, proceeding thence to the works of Messrs. Muir & Houston, Kinningpark, Glasgow. His connection with the Corporation Electricity Department started in 1898, and, after working up through the various grades, he was appointed resident engineer at the Port Dundas station. During the three years in which he held this post, important extensions were carried out at the station, which at that time was the largest generating station in the Glasgow system. His next position was that of mains superintendent, and for 12 years Mr. Mitchell had entire charge of the transmission and distribution sides of the undertaking. In 1917 he was appointed deputy chief engineer and superintendent of stations; in 1920 he became engineer and manager, a position which he still holds. He has therefore had 25 years' service with the Corporation. Mr. Mitchell is a member of the Institution of Electrical Engineers and of the American I.E.E.; he is a member of the council of the Institution of Engineers and Shipbuilders in Scotland; and member of the council and chairman of the Electrical Apparatus Committee of the Incorporated Municipal Electrical Association. He is also president of the Corporation Electricity Department Engineering Society, and takes a very prominent part in connection with various welfare societies.

W. Ralston [*Glasgow.*

Mr. R. B. Mitchell, M.I.E.E.,
Chairman of the Scottish Centre of the I.E.E.

At the last meeting of the Stepney Borough Council the recommendation of the General Purposes Committee that annual payments of £100 to Mr. B. J. Belsher (the borough engineer), and £25 to Mr. B. W. Stuttle (principal engineering assistant) in recognition of services rendered by them to the electricity supply undertaking, was referred back. In the discussion on the recommendation, several Councillors expressed the opinion that the salaries of the officers of the Council should be inclusive, irrespective of the work undertaken for other departments. Ald. Grove (the chairman of

the committee) pointed out that the work for the Electricity Committee had always been regarded as outside the duties of the borough engineer.

Mr. C. S. TAYLOR, M.I.E.E., M.Am.I.E.E., was appointed deputy engineer-in-chief and manager of the Shanghai Municipal Electricity Department last January, in succession to Mr. A. H. BLAGDEN, who resigned after 21 years' service. Mr. Taylor joined the department in 1913, and at the time of his promotion to deputy was holding the position of power engineer.

The Dublin Corporation Electricity Committee has recommended the appointment of Mr. R. J. DILLON, senior member of the electrical staff, with twenty years' service, to have charge, under Mr. L. J. KETTLE, City electrical engineer, as manager of the undertaking, at a salary of £500 per annum, rising by annual increments of £25 to a maximum of £750; and that Mr. G. ARCHER, deputy electrical engineer, with 25 years' service, be given an increase on present salary (£700), to £750, with one further increment of £50 to £800, without war bonus.

Mr. C. J. MACKENZIE-GRIEVE has been appointed a director of the Southern Brazil Electric Co., Ltd.

Mr. T. B. DRUMMOND, chief draughtsman, Liverpool Corporation Electric Supply Department, was presented on November 1st by the staff with a silver salver on the occasion of his silver wedding. Mr. Dickinson (city electrical engineer), who made the presentation, referred to Mr. Drummond's 35 years' connection with the Liverpool Electric Supply Co., Ltd., and the Liverpool Corporation. Mr. P. J. Robinson (deputy electrical engineer), Mr. Smith (engineer's secretary), and others spoke appropriately, and Mr. Drummond responded.

Mr. H. TOMLINSON LEE, formerly borough electrical engineer at Wimbledon, has been returned as an Independent member of the Wimbledon Council, polling 1,466 votes, or 473 more than his opponent.

Mr E. M. PEARSON, of Fulham, has been appointed mains superintendent in the Lancaster Corporation Electricity Department.

After 29 years' service, Mr. R. RILEY has resigned his position as traffic superintendent in the Blackburn Corporation tramway department, to take up poultry farming. Mr. Albert Potts, formerly an inspector, has been appointed to succeed him, and has taken up his duties. The Blackburn staff presented Mr. Riley with a mahogany timepiece. Mr. J. H. Cowell, the general manager, made the presentation.

Last Saturday night, at the Queen's Hotel, Birmingham, the staff of the Birmingham electric supply department entertained Mr. R. A. CHATTOCK to dinner in commemoration of his 20 years' service with the Corporation, and his association with the Nechells station, which was recently opened by the Prince of Wales. Ald. J. B. Burman, chairman of the Committee, presided, and there was a full attendance of present and past members of the Committee. The toast "Our Guest" was submitted by the Lord Mayor (Ald. Sir David Davis), who referred to the great esteem and respect in which Mr. Chattock was held by his staff. The toast was supported by Mr. E. J. Jennings, secretary of the department, and Mr. F. Forrest, chief assistant electrical engineer. Mr. Chattock suitably replied.

The new Lord Mayor for Bristol is Alderman A. A. SENINGTON, who for several years has been vice-chairman of the Bristol Electrical Committee. He is the Employers' Representative on the No. 6 District Joint Board, of which he has been chairman since its inception.

The following awards have also been made by the President and Council of the Royal Society:—

The Copley Medal to Professor H. LAMB, F.R.S., for his researches in mathematical physics; the Davy Medal to Professor H. B. BAKER, F.R.S., for his researches on the complete drying of gases and liquids; the Hughes Medal to Professor R. A. MILLIKAN, for his determination of the electronic charge and of other physical constants.

We are informed that Sir GEORGE GIBB has joined the Board of the Oriental Telephone and Electric Co., Ltd., and of the China and Japan Telephone and Electric Co., Ltd., and has been elected chairman in succession to the late Sir Henry Babington Smith.

Dr. CHARLES C. GARRARD, of the General Electric Co., Ltd., Witton, Birmingham, has recently been appointed an elected member of the Council of the Birmingham Chamber of Commerce.

Obituary.—DR. J. E. STEAD, F.R.S.—We regret to record that Dr. John Edward Stead, a celebrated authority on the metallurgy and manufacture of steel, and a past-president of the Iron and Steel Institute, died on October 31st, after a long illness, at the age of 72 years. Dr. Stead read numerous papers before the above Institute and other technical societies.

Mr. G. F. BENNETT.—The following announcement appeared in *The Times* "Deaths" column: On October 28th, in London, George Felix Bennett, electrical engineer, son of the late James and Mrs. Bennett, of Elgin, N.B.

Mr. W. A. PEARE.—The death took place on October 28th of Mr. William Alfred Peare, of 65, Palmerston Avenue, Litherland, who was for over 30 years on the electrical staff of the Cunard Steamship Co., Liverpool. He was 68 years of age.

Mr. W. BLENHEIM.—The death is announced of Mr. William Blenheim, who was for many years head of the firm of William Blenheim & Co., electrical engineers, of Egham, Surrey. He was 75 years of age.

Mr. H. HATTON.—The death occurred suddenly on October 28th, at his residence at Tunbridge Wells, of Mr. Harold Hatton, chief inspector of Post Office telephones. Deceased, who was 44 years of age, entered the employment of the National Telephone Co. as a lad at Brighton, and at the age of 21 he was placed in charge of the Liverpool exchange. Twenty years ago he was appointed chief inspector by the company, and continued this position under the Post Office.

Mr. S. PAULS.—We regret to learn that Mr. S. Pauls, A.M.I.E.E., borough electrical engineer, Middleton, passed away on Saturday, November 3rd, at his residence, "Mayfield," Archer Park, Middleton. He was 51 years of age.

Mr. W. J. CORSE.—The death occurred at his residence at Plymouth, on November 6th, at the age of 74 years, of Mr. William John Corse. On retiring from the Navy in 1880 he set up in business at Plymouth as an electrical engineer. During his 40 years' business activity in Plymouth he carried out many big contracts, among them being the installation of electrical plant at the Naval Barracks at Devonport, Bull Point ammunition stores, and the *Western Morning News* offices. Later he interested himself in the application of electricity to the kinematograph.

NEW COMPANIES REGISTERED.

Compare Secret Radio Telegraph Co., Ltd. (193,362).—Private company. Registered October 26th. Capital, £200 in 1s. shares. To acquire and turn to account any patents, rights and inventions relating to telegraphy, signalling, electric apparatus and appliances for operating and controlling musical instruments and other matters in connection with electrical inventions, &c. The subscribers (each with one share) are:—G. A. O'Hanlon, Brambletye, Oxted, Surrey, director; R. Coit, 17, Palace Gate, W.8, merchant. The subscribers are to appoint the first directors. Secretary: A. R. Jeffers. Registered office: 13, Copthall Avenue, E.C.2.

Ringwood Electric Supply Co., Ltd. (193,331).—Registered October 25th. Capital, £10,000 in £1 shares. To adopt an agreement between J. H. Bartlett of the one part and K. Gladstone, C. E. Blackstone, and H. J. Barrow of the other part to apply to the Electricity Commissioners for a special order authorising the company to supply electricity to the town of Kingwood and neighbourhood, but limited to such area as the Commissioners shall specify, &c. The first directors are:—K. Gladstone, Moortown House, Kingwood; R. W. Christy, "Greyfriars," Kingwood; H. Southall, Poulner Road, Ringwood; E. V. Jones, Mansfield House, Ringwood; C. E. Blackstone, Carlton House, Kingwood; A. J. Abbott, J.P., Strathmore, Westby Road, Boscombe, Bournemouth (chairman); A. H. Abbott, Portman Cottage, Boscombe, Bournemouth; H. J. Barrow, Fridays Cross, Ringwood. Minimum cash subscription, £10,000. Qualification, £200. Registered office: The Mill, Ringwood, Hants.

Lighting, Heating and Glass, Ltd. (193,456).—Private company. Registered October 31st. Capital, £1,000 in £1 shares. To carry on the business of general merchants, importers or exporters, mechanical engineers, electricians, suppliers of or dealers in electrical apparatus, manufacturers of and dealers in glass and glass articles or other appliances and chemicals and apparatus required for or capable of being used in connection with the supply of glass, gas, electricity, or any other illuminating or heating agent or of power, &c. The subscribers (each with one share) are:—A. J. H. Snay, Bilbao House, New Broad Street, E.C., incorporated accountant; A. T. Keens, Bilbao House, New Broad Street, E.C. J. Wyatt, director of Albert Lee & Co., 1923, Ltd., is permanent governing director, with remuneration as fixed by the company. No qualification required. Registered office: Bilbao House, New Broad Street, E.C.

Davis, Ash & Co., Ltd. (193,425).—Private company. Registered October 30th. Capital, £10,000 in £1 shares. To acquire the business of Messrs. Ash & Hart, electrical and mechanical engineers, carried on at 70, Victoria Street, S.W.1, and to carry on the same and the business of founders, manufacturers of agricultural implements and other machinery, &c. The first directors are:—H. S. Davis, 73, Montague Street, Worthing, merchant; J. J. Ash, 21, Maresfield Gardens, Hampstead, N.W.3 (permanent). Not more than five others are to be appointed by the subscribers. Qualification, 200 shares. Registered office: 15, Grape Street, Shaftesbury Avenue, W.C.2.

W. H. Miller & Co., Ltd. (193,477).—Private company. Registered October 31st. Capital, £2,000 in £1 shares. To carry on the business of manufacturers and repairers of, agents for and dealers in electrical goods and accessories, fittings, switchboards, indicators, bells, automatic time recorders, clocks, time switches, flashers, engine controls, &c. The permanent directors are:—S. F. Stansfield, "Oaklands," Poulton-le-Fylde, cotton manufacturer; S. Woolnough, Beech Avenue, Poulton-le-Fylde, mill furnishers. W. H. Miller, 76, Warley Road, Blackpool, electrical engineer; A. Reynolds, no address given. Each of the first directors who dies whilst holding 500 shares may by his will or codicil appoint any person to be a director, who may retain office so long as not less than 500 shares stand in the name of the deceased directors. Remuneration as fixed by the company. Registered office: Queen's Square, Poulton-le-Fylde, Lancs.

Harden Cartwright, Ltd. (193,340).—Private company. Registered October 25th. Capital, £1,000 in £1 shares. To adopt an agreement with H. Cartwright, W. T. Arkinstall, J. H. Mees, Martha L. Bate, J. N. Wylde, and W. J. Cartwright for the purchase of the business of electric, gas, steam, hot water and motor engineer and plumber carried on by the said H. Cartwright at 19, Albion Street, Brierley Hill, Stafford. The first directors are:- H. Cartwright, 64, Talbot Street, Brierley Hill, electrical engineer and plumber; W. T. Arkinstall, 73, Adelaide Street, Brierley Hill, electrical engineer. Qualification, £10 shares. Remuneration as fixed by the company. Registered office: 19, Albion Street, Brierley Hill.

Wilfred Cross & Co., Ltd. (193,442).—Private company. Registered October 30th. Capital, £1,000 in £1 shares. To acquire the business of electrical and general engineers, car and cycle dealers and machinists, &c., carried on by W. Cross at 11, Quarry Road, Tunbridge Wells, Kent, and to carry on the business of manufacturers of and dealers in wireless apparatus, automobiles, motor cars and cycles, &c. The first directors are:—W. C. Cross, 6, Dunstan Road, Tunbridge Wells; Mrs. F. M. Cross, 6, Dunstan Road, Tunbridge Wells. Remuneration as fixed by the company. Secretary: E. Lester. Registered office: 4, Dudley Road, Tunbridge Wells.

Ateliers de Constructions Electriques de Charleroi (1,999).—Particulars filed on October 29th, 1923, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is 80,000,000 fr. in 320,000 shares of 250 fr. each. The company was incorporated in Belgium on July 7th, 1904, to manufacture, construct and install in Belgium and elsewhere mechanical objects, apparatus and accessories relating to the electrical industry, &c. The British address is at 56, Victoria Street, S.W., where J. H. Bunting is authorised to accept service of process and notices on behalf of the company. The directors are:—Baron Edouard Empain, Baron Francois Empain, R. Boulvin, E. Harment, E. Demeure, E. Francqui, J. Jadot, and Baron Edouard Rolin-Jaequemyns, all of Brussels; E. Clementel, Versailles; and J. Dulait, Montigny-le-Tilleul.

Wormit Electric Light Co., Ltd. (12,878).—Registered in Edinburgh October 27th. Capital, £2,000 in £1 shares. To take over the business of manufacturers and suppliers of electricity, recently carried on by the Tayside Electric and Gas Light Company, Ltd. (in liquidation). The first directors are:—W. A. Craigown, 14, Hillpark Terrace, Wormit, secretary of a company; J. G. Belford, Tayside, Wormit, merchant; J. Coutts, Clifton, Wormit, ironmonger; W. R. Cowley, Riverside, Wormit, calenderer; J. F. Fleming, Clunie House, Wormit, solicitor; D. J. McKinnon, Southfield, Wormit, trawler owner. Minimum cash subscription, 6 shares. Qualification, £25 shares. Registered office: Newburgh Road, Wormit.

Kingston Automobiles and Electric, Ltd. (193,526).—Private company. Registered November 2nd. Capital, £1,000 in £1 shares. To carry on the business of automobile, electrical and mechanical engineers, motor-body builders, mechanics and repairers, garage proprietors, makers of electrical, wireless, and radio apparatus, &c. The first directors are:—G. L. Wilks, "Fairseat," Cobham, Surrey; G. C. Carter, 40, Cranes Park, Surbiton. Qualification, 50 shares. Remuneration, 10 guineas each per annum. Secretary: G. C. Carter. Registered office: 35, Surbiton Road, Kingston-on-Thames.

H. T. C. Electrical Co., Ltd. (193,521).—Private company. Registered November 2nd. Capital, £2,500 in £1 shares. To acquire the business now carried on at 2a, Boundaries Road, Balham, by C. F. Hurst, A. H. Triggs, and M. Cooper, as the "H. T. C. Electrical Co.," and to carry on the business of manufacturers of, and dealers in drawn wire, electric cabling and electric lamps, and all other articles made from tungsten, molybdenum, and other metal, manufacturers of and dealers in wireless apparatus, &c. The first directors are:—C. F. Hurst (chairman), 15, Madeira Avenue, Worthing; A. H. Triggs, 60, Tarring Road, Worthing; M. Cooper, 44, Milman Road, N.W.6; H. F. Arrow, 17, Huron Road, Balham, S.W.17. Registered office: 2a, Boundaries Road, Balham, S.W.4.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Berkeley & Young, Ltd.—Satisfaction in full on October 11th of debenture dated February 5th, 1923, securing all moneys due or to become due from the company to Barclay's Bank.

New British Electric Supply Co., Ltd.—Satisfaction in full on October 11th, of guarantee and charge dated February 5th, 1923, securing all moneys due not exceeding £26,000 (payable in respect of a guarantee of the account of Berkeley & Young, Ltd.).

General Cable Manufacturing Co., Ltd.—Satisfaction in full on October 26th, 1923, of debentures dated December 3rd, 1920, securing £6,000.

International Electric Co., Ltd.—Satisfaction in full on October 12th, 1923, of mortgage debenture dated May 6th, 1920, securing all moneys due or to become due.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—Trust deed dated October 12th, 1923, to secure £150,000 debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: C. Ogle, Austin Friars House, E.C., and G. H. Fookes, 100, Union Court, Old Broad Street, E.C.

International Electric Co., Ltd.—Particulars filed of £70,500 debentures authorised October 12th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

British Gramophone and Wireless Co., Ltd.—Particulars filed of £7,000 debentures authorised October 6th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £5,000.

Satisfaction in full on October 22nd of debenture dated September 19th, 1923, securing £150.

J. A. Groome, Ltd.—Debenture dated October 2nd, 1923, to secure £100, charged on the company's undertaking and property, including uncalled capital. Holder: S. L. Davies, 17, Windsor Road, Willesden Green, N.W.

Andcole & Turner, Ltd.—Particulars filed of £3,000 debentures authorised October 29th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

General Radio Co., Ltd.—Issue on October 24th, 1923, of £2,000 debentures, part of a series already registered.

Frank Craft (Castleford), Ltd.—E. V. Williamson, of East Parade, Leeds, was appointed receiver and manager on October 24th under powers contained in debenture dated October 3rd, 1923.

Llangollen and District Electric Light & Power Co., Ltd. (75,384).—Return dated August 6th, 1923. Capital, £6,000 in 3,500 ordinary and 2,500 preference shares of £1 each. 1,754 ordinary and 360 preference shares taken up. £1 per share called up. £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges, £4,000.

CITY NOTES.

Norwich Electric Tramways Co.

At the annual meeting, held on October 30th, the directors reported that the total receipts for the year ended June, 1923, were £81,488, a decrease of £4,660, while the total expenditure was £61,128, a decrease of £11,625. The net profit at £20,360 was £6,966 better than for the previous year. The passengers carried increased from 11,857,956 to 11,687,362; the earnings per car-mile fell from 20.67d. to 19.51d., but the expenses per car-mile fell from 16.82d. to 14.0d.; the earnings per passenger fell from 1.72d. to 1.64d. After transferring £10,000 to reserve for carrying out the renewal programme now in progress, and paying a dividend of 3 per cent. (subject to income tax), as against 2 per cent. for the previous year, £2,555 is carried forward.

Prospectus.

Tata Power Co., Ltd.—The prospectus was published on Monday offering for subscription an issue of £1,000,000 4½ per cent. guaranteed "A" mortgage debenture stock, 1929-1948, at 97 per cent. The company was incorporated in 1919 and is the largest of three power supply companies formed under the concessions acquired by Messrs. Tata, Sons & Co., or Tata, Sons, Ltd., from the Government of Bombay, and was formed with a view to the generation and sale in Bombay and districts of electric energy generated by water power from the Nila Mula Valley in the Poona district of the Bombay Presidency. The necessary hydro-electric works are about to be carried out. The plant, which will be installed immediately, is expected to start supplying power in 1926-27, and to be capable of delivering in Bombay 210,000,000 B.T. units per annum. Water storage is being developed, which by the addition of further generating plant should enable 400,000,000 units per annum to be available in Bombay. The demand for energy is assured and will probably increase in the near future. The proceeds of the present issue will be devoted mainly to the purchase in Great Britain of machinery and plant required for the proposed works.

Aluminium Corporation, Ltd.

The report submitted at the annual meeting, held yesterday, covered the year ended December, 1922. It expressed regret at the death of Mr. J. W. Cassells, and of the late secretary, Mr. C. E. Hemmings. The balance at the credit of profit and loss account, after allowing for the debenture interest to December 31st, 1922, and preference dividend for 1921, amounts to £18,659. A dividend of 7 per cent. (less income tax) upon the preference stock and shares is recommended, absorbing, after deducting income tax, £12,563, and leaving a balance of £6,096 to be carried forward. Work is actively proceeding upon the construction of the new power house, pipe line, and low-level dam at Dolgarrog, to ensure the increased supply of electrical energy required by the agreement with the North Wales Power Co., Ltd. In view of the possibility of further extensions being required an extraordinary general meeting was to follow the annual meeting yesterday, to authorise an increase in the borrowing powers by the sum of £500,000.

Cape Electric Tramways, Ltd.—The report shows a profit of £84,621 for the year ended June, 1923. After meeting debenture interest and redemption charges, and including the amount brought forward, there is a balance of £64,338. £20,000 is put to reserve. The total dividend for the year is to be 6 per cent., free of tax, and £14,865 is to be carried forward. According to *The Times*, the passengers increased by 810,664 to 32,094,580, but the gross receipts fell by £5,817 to £408,753. The profit is £84,621, as stated, as against £80,703 for 1921-22.

American Telegraph and Telephone Co.—On November 5th a group of American bankers, including the National City Co., offered $100,000,000 American Telegraph and Telephone Co. 20-year 5½ per cent. debentures at the price of 98½ and interest New York terms. The debentures are callable at 110. The proceeds of the issue will be utilised for additions and betterments and to redeem $40,000,000 6 per cent. notes due February 1st, 1924. The issue was quickly over-subscribed. —*Financial Times.*

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted: :—

Urban Electric Supply Co.—£250,000 5½ per cent. mortgage debenture stock.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Tata Power Co.—£1,000,000 4½ per cent. guaranteed "A" mortgage debenture stock, 1929-1948, issued at 97 per cent., fully and partly paid.

Cawnpore Electric Supply Corporation, Ltd.—Interim dividend of 3 per cent. on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

Outpourings of new capital continue to be one of the principal features of Stock Exchange life, and the appetite of the investor for more and more good stock is unabated. It has some effect upon the securities already existent, though this influence is by no means as great as might have been expected. The speculative investor continues to put substantial money into semi-speculative stocks. The investor still hungers after electricity shares, the supply of which is contracted and meagre. Were it not for the slight apprehension which continues to lurk in connection with wireless, there would pro-

bably be a brisk demand for the stocks of the cable companies, considering that these last-named pay good interest on the money. The fact of the dividends on the Eastern group being distributed free of tax is held to be something of a disadvantage at times when there may be a prospect of income tax declining. In view of recent dicta of the Chancellor of the Exchequer, there appears to be little hope of a lower income tax being inaugurated next April, so that this consideration need not weigh with those who are on the look-out for good investments, the dividends on which are paid free of tax.

Brompton ordinary have risen to 2¼, while Newcastle-on-Tyne ordinary fell back to 15s. These are the only changes amongst this class of share. The preferences, however, continue in demand, and Edmundson's preference at 5 3/16, and London Electric preference at 5¼ are both higher. The cheery speech made by Sir Harry Renwick at last week's meeting of the Provincial Electric Supply Association of the United Kingdom has received wide attention. A year ago Sir Harry dwelt upon what he described as the "Golden Age of Electricity," and certainly he can claim that the aphorism is proving itself to be justified. It would be difficult, indeed, to find any other branch of industry in this country which is making more profitable strides at the present time.

Were proof required from the financial, as distinct from the technical, point of view, this is unmistakably furnished by reference to the list of share-prices in our weekly table. Nor is it only the shares of the London companies that have appreciated so substantially during the past twelve months. Interest has been quickened in the shares of provincial and suburban electric supply undertakings, while the splitting of their shares into the popular £1 denomination by many of the leading companies is an indication that directors recognise the reasonableness of a public desire to participate in the flourishing industry.

The railway companies are fully alive to the opportunity which presents itself to them at the present time for electrification of their systems. The necessity for co-operation with the Government in provision of work for the unemployed acts as a spur to effort, and to enterprise, in the way of electrifying the railways, and with the Government benevolently ready to assist in the matter of guaranteeing capital issues, it is safe to assume that during the next few months there will be large sums raised for this purpose.

In the expectation that manufacturing firms will stand to benefit from big contracts in connection with electrification and telephonic work, the shares in a few of the best-known companies are beginning to improve. Siemens, for instance, have come into demand by reason of the expectation that the company will receive large orders in connection with the installation of automatic telephones. The price of the ordinary shares has risen to 15s., and the preference to 25s. 3d. It may be recalled that the latter, which are cumulative, have received no dividend since July, 1922, and hopes have been raised that the company may be able to pay its dividend on the preferences, with arrears, up to the end of this year.

Metropolitan-Vickers ordinary have risen to 26s. 6d., and the preference to 53s. 9d.; English Electrics to 18s. 3d. Of the cable shares, Callenders recovered the dividend deducted last account-day, and are 49s. 6d. x.d., Henley's hardening to 5⅞. India rubber shares, after putting on 2s. at 12s. 6d., went back to 11s. 9d., which leaves them 1s. 3d. better on balance. Babcock & Wilcox at 45s. 7½d. are ex dividend.

Metropolitan Consolidated, after a rise to 79¼, fell to 77¼, though Districts retain their price at 56½. The Underground group is not so good as it was. Both classes of the newly-issued London Electric and City & South London 4½ per cent. debenture stocks, which came out at 95½, fell back to 3/16 premium. Investment stocks as a whole are coloured by apprehensions of what may happen if there is a General Election and the Labour Party is returned to power. It is not that the City has any particular animus against the Labour Party as such, but the fact that the Party has never occupied office before, and that a capital levy and nationalisation are frequently advocated by its leaders are sufficient in themselves to raise a trace of anxiety in the mind of the capitalist, be he great or small.

The Mexican Utility group is still disposed to heaviness. Monterey "A" debenture fell 2 to 36½, and the company's other issues are also weaker. On the other hand, Canadian General Electric Common shares have spurted to 123½, on the proposed acquisition of a controlling interest in the company's common share-capital by the General Electric of New York. Montreal Light & Power at 141½ is 2½ up, and Melbourne Electrics rose to 170. Calcutta Tramways preference strengthened to 16s. Shanghai Electric Constructions are ¼ up at 2⅝. Brazilian Tractions at 44 x.d. show no change worth mentioning.

The rubber market is quiet, with a certain amount of disappointment evident at the way in which the price of the raw material has sagged, instead of rising, as it was confidently expected to do. Vickers shares were run up by provincial buying, because of the Government's new shipping orders, and other iron and steel shares advanced briskly, though the rises brought in shares from the North, and prices receded from the best.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Nov. 6, 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	2¼	+ 1/16	£5 13 0
Charing Cross Ordinary	5	9	14	13	—	5 7 8
do. do. do. 4½ Pref.	5	4½	4½	4 5/16	—	5 4 4
Chelsea	1	6	10	38/-	—	5 5 3
City of London	1	14	15	3 1/16	—	5 17 0
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 4 4
County of London	1	8	10	2 1/16	—	4 16 10
do. do. 6 % Pref. ...	1	6	6	23/3	—	5 3 3
Edmundson's Ordinary	3	Nil	7	4½	—	5 2 0
do. 6 % Pref	5	12/-	6	5 3/16	+ 3/16	5 15 8
Kensington Ordinary	5	10	12	10½	—	5 18 5
London Electric	3	4	10	5	—	5 19 9
do. do. 6 % Pref. ...	5	6	6	5½	+ ⅛	5 9 1
Metropolitan	1	7	8½	1⅞	—	4 17 2
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	15/-	— 1/16	3 6 8
do. 5 % Pref. ...	1	5	5	15/9	—	6 7 0
do. 7 % Pref. ...	1	7	7	23/-	—	6 1 9
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	16/3	—	Nil
do. 5 % Pref. ...	1	2½	5	¾	—	6 17 0
James' and Pall Mall ...	5	12	14½	11¾	—	6 2 1
South London	1	7	10	1 13/16	—	5 3 3
South Metropolitan Pref. ...	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	10	12	10½	—	5 14 3
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	1	—	7 10 0

Home Rails.

Central London Ord. Assented	Stock	4	4	7⅜	—	5 9 7
Metropolitan	,,	2½	3½	77½	−1½	4 10 4
do. District	,,	1	3	56½	—	5 6 2
Underground Electric Ordinary	10	Nil	Nil	3½	—	Nil
do. do. "A" ...	1	Nil	Nil	10/-	—	Nil
do. do. Income Bonds	4	5	99	—		*5 1 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	+ ½	5 16 6
do. Def.	,,	1½	34/6	21	+ ⅛	6 9 0
Chile Telephone	5	6	6	6	—	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17½	—	5 16 0
Eastern Tel. Ord.	Stock	10	10	174½	−1	5 16 0
Globe Tel. and T. Ord.	10	10	10	18	—	5 11 0
do. do. Pref.	10	6	6	11½	—	5 7 7
Great Northern Tel.	10	21	22	18	+ ½	7 17 2
Indo-European	25	10	7	8½	—	*3 7 8
Marconi	1	25	15	2½	− 1/16	6 13 4
Oriental Telephone Ord. ...	1	12	12	1⅞	—	*6 6 0
United R. Plate Tel.	5	8	8	6½xd	—	*5 16 4
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	17½	—	*5 16 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	2¾	—	9 7 2
do. do. 2nd Pref.	5	Nil	5½	1⅞	+ ⅛	10 0 0
do. do. 5% Deb.	Stock	5	5	76½	—	6 10 9
British Electric Traction Ord.	,,	4½	5	74½	—	6 14 1
do. do. 6 % Pref.	,,	6	6	101½	—	5 18 3
Brazil Tractions	100	Nil	4	44xd	—	9 1 10
Brit Colmbia Elec. Rly. Pcs.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	,,	5	90/-	81½	—	*5 14 1
do. do. Deferred	,,	3	127/-	94½	−2	*6 11 3
do. do. Deb. ...	,,	4½	4½	78½	—	5 8 3
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	9/-	—	11 2 0
London United Tram. Deb. ...	Stock	4	4	60	—	6 13 4
Mexico Trams. 5 % Bonds ...	—	Nil	Nil	16½	—	6 10 9
do. 6 % Bonds ...	—	Nil	Nil	54½	—	Nil
Mexican Light Common ...	100	Nil	Nil	24	—	Nil
do. Pref.	100	Nil	Nil	53½	—	Nil
do. 1st Bonds ...	—	Nil	5	68½	—	6 0

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2 3/16xd	—	*4 7 9
British Aluminium Ord. ...	1	10	5	18/3	—	5 9 8
British Insulated Ord.	1	15	15	2½	—	6 0 0
Callenders	1	15	15	49/6xd	+9d.	6 1 2
do. 6½ Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	1	10	Nil	4/6	—	Nil
do. do. 5% Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	29/6	−6d.	6 15 7
English Electric	1	8	5	18/3	+6d.	5 9 7
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 3
do. Ord.	1	10	5	1	—	5 0 0
Henley	1	15	15	2½	+6d.	6 0 0
do. 4½ Pref.	5	4½	4½	4½	—	5 2 10
India-Rubber	1	10	—	11/9	+1/3	—
Met.-Vickers Pref.	2	8	8	3½	+ 1/16	5 19 0
Siemens Ord.	1	10	10	15/-	+9d.	Nil
Telegraph Con.	12	20	20	25	—	*5 0 0

* Dividends paid free of Income Tax.

PROVINCIAL ELECTRICITY SUPPLY UNDERTAKINGS.

[Sir Harry Renwick's Review of the Situation.]

The sixth annual meeting of the Provincial Electric Supply Committee took place at the Holborn Restaurant on October 30th, preceded by a luncheon. Sir Harry Renwick, K.B.E., chairman, presided.

Among those present were Lord Erskine (Coatbridge), Sir James Devonshire (N. Met. Co.), F. E. Gripper (Edmundsons), Sir James Szlumper (Richmond), A. A. Campbell Swinton (Cambridge), Sir Henry Mance (Oxford), G. W. Spencer Hawes (Reading), Dr. J. A. Hosker (Bournemouth), Alderman C. Spurgeon (Folkestone), C. G. Tegetmeier (B.E.F.), C. J. Somerville (Banbury, Lewes, &c.), E. MacGregor Duncan (Windsor), J. H. Edwards (Stroud), W. B. Esson (Chiswick), H. Bentham (B.E.F.), A. N. Rye (Edmundsons), Napier Prentice (East Anglian), H. D. Leather (Minehead), Talfourd Ely (Ross), F. C. McQuown (Richmond), T. W. Cole (secretary), G. E. S. Venner (Leatherhead), H. B. Harvey (Kent), G. Verity (Brentford), G. H. Jackson (Northampton), J. A. Saner (Northwich), E. Gimingham (Altrincham), W. Rendell-Baker (Stratford-on-Avon), H. C. Walker (Carmarthen), H. Brown (Isle of Thanet).

The chairman said that the most interesting feature of their last year's working was the passage of the Electricity (Supply) Act, 1922, a measure designed to facilitate the formulation of various schemes which were being promoted under the Electricity (Supply) Act, 1919. A large part of the country had already been delimited into various electricity districts, and schemes for those districts were in varying stages of completion. They were told that once the Electricity (Supply) Act, 1922, came into force all difficulties would vanish and all would be plain sailing. But except for legalising the finance of certain schemes the Act seemed to have helped matters forward very little. Enthusiasm for fully-fledged Joint Electricity Authorities had in a large measure petered out; indeed, the schemes which were going along most smoothly were those which were furthest removed from a Joint Electricity Authority scheme, as, for instance, the now-operative schemes of the South-West Midlands and South-East Lancashire. In the case of the other operative Order (the North Wales and South Cheshire), where a Joint Electricity Authority was created, its real executive powers were deputed to a power company, so that even there they had not a Joint Electricity Authority pure and simple as conceived by the Act.

There were a number of contributory causes—political, social and otherwise—independent of electrical considerations, which might account for the general reluctance to set up fully-fledged Joint Electricity Authorities. The Commissioners had their full sympathy in the onerous work before them, and their thanks for what they had accomplished in the past, for an immense impetus had been given to the electric supply industry since the Commissioners came into office. They had established certain leading principles and these should make for that full development of the industry for which they had been looking for so many years past, a goal they would certainly reach if the industry was given a proper measure of freedom and a fair chance of working out its own salvation.

A number of their member-companies availed themselves of the Trade Facilities Act, 1921, to secure loans for developing their undertakings. That Act, however, only ran for one year. They actively supported the extension of these facilities for another year, and the Trade Facilities and Loans Guarantee Act, 1922, extends the privileges until December of the present year. The powers under the 1922 Act were extended from £25,000,000 to £50,000,000, and altogether up to date £4,645,100 had been guaranteed as loans to the Electric Supply Industry, that was to their member-companies and other electric supply companies.

As the result of their representations in the proper quarter the Minister of Labour intimated just before the recess that the Unemployment Grants Committee, whose operations hitherto had been exclusively with municipalities, would now extend their grants to public utility companies. The Provincial Supply Committee at once got into touch with that committee and obtained the conditions under which these grants would be made, and circulated them to their companies. This was in August last and they had been in communication with some of their member-companies with a view to their participating in the extended privileges. He did not think the Government had gone far enough in their case as the assistance they offered was tied up with very strict conditions, and moreover, the monetary advantages offered were not as liberal as they might be. For instance, the operations of the scheme were limited to one year, the main object being apparently to assist unemployment in the coming winter, but local authorities had for years past been allowed to obtain Government grants for works that were wholly non-revenue producing. In the case of the electric supply industry, however, there were many schemes of public importance, indeed, of public necessity, which, although unremunerative in the early stages, would become profitable in the end, and such works many of their friends would be prepared to put in hand if Government would help them over the lean years, both as to capital and interest, and if the Government was not prepared to take risks, then perhaps it would be prepared to stand behind a public company formed for the purpose, which would finance such schemes as he had referred to.

Public utility companies had never received from Parliament that encouragement in the public interest to which they were entitled, and certainly nothing like the encouragement given in America, and a far larger and more liberal measure of treatment should be extended to public utility companies in general.

Last year they were faced with the disconcerting fact that their exemption from the Corporation Tax finished in December, 1922. This tax, if it had come into force in their companies, would have added to their shoulders a material burden, so they made every effort to get further exemption, including memorialising the Chancellor of the Exchequer. Finally, they secured a further exemption of three years, so that they were now safe until 1925, when possibly the Corporation Tax would disappear altogether.

Regarding labour questions, the committee took a very active part in the Whitley Council and Boards governing the industry. The work last year would be summarised as follows:—

"Wages in every area have been revised to meet the new conditions. In certain areas considerable reductions in wages took place. A sliding scale has been continued, so that progressive reduction takes place as cost of living falls. A new schedule of salaries and working conditions for our staff members has been formulated and came into force on June 1st, and we protected our small undertakings by arranging for those of 1,000 kW and under to be excluded."

All this had been done with the best of feeling on both sides, and they were much indebted to their representatives on these Councils, and particularly to Mr. Scott-Moncrieff.

The speaker went on to refer to general legislation, and he alluded to the Rating of Machinery Bill, which did not affect the rating of their own undertakings, but at the same time the incidence of the proposed alteration was such as to encourage the use of electric motors instead of prime generators of power, and so was of indirect benefit to the electric supply industry as a whole. The Smoke Abatement Bill had passed Second Reading in the House of Lords. They would like to see all smoke done away with, but there were points which would be dealt with when the proper time arrived.

The speaker referred to the important clause which they got inserted in the 1922 Act dealing with revision of charges. Many undertakings which had been debarred hitherto from obtaining an increase under the Electricity Supply Acts could now do so under this Act. This provision was the more important since the Statutory Undertakings (Temporary Increase of Charges) Act, which was the only refuge for such undertakings, terminated this year. A certain number of undertakings enjoyed their increased charges under the temporary Act, and they obtained new Orders confirming their increased charges.

Another matter which they successfully urged should be dealt with in the 1922 Act was that of overhead mains, a question which figured largely in the problem of the re-organisation of electric supply and the distribution over wide and scattered areas where economy was of paramount importance. In both of the recent Electricity (Supply) Acts, 1919 and 1922, they obtained a certain amount of favourable provision, but were still up against very drastic regulations and the difficulty of getting consent to wayleaves. During the past year the committee had been hard at work on these matters, and they hoped that, as the fruit of their labours, the regulations would be brought to commonsense proportions.

As an isolated industry they ought certainly to benefit by Unemployment Insurance by Industry, since their margin of casual labour or unemployment was a very small percentage compared with other industries. There were many factors, however, that entered into consideration, and the problem was a very complex one.

Later the chairman referred to the co-operation of the Provincial Committee with B.E.D.A., and he urged the latter's appeal for subscriptions from all undertakings of the country toward the cost of the electricity exhibit at the British Empire Exhibition upon the notice of members as deserving their serious and generous consideration.

Concerning the prospects of the industry, Sir Henry was a firmer believer than ever in the great future that was before them. A great change had come over the industry. They had entered the area of big things. As to capital, they were dealing nowadays in millions instead of in thousands, as before the war; their electric generators were many times as big and vastly more economical; and the country's output of electricity was now measured in many thousands of millions of units. Again, the eyes of the whole country were turned in the direction of electrical development. Railway magnates saw in the electrification of their lines the key to their problem and huge

railway electrification projects were being formulated. The Government in their search for revenue-producing works to help unemployment had given a first place to electricity schemes. In the industrial world manufacturers had only one watchword, and that was "electric power." Even in the modest realms of domesticity the servant shortage and the resolution of the housewife to lessen work had opened immensely wide fields for electric household appliances.

Lastly, they had the confidence of the public, not only as consumers, but as investors. Things had also immensely changed in this direction, for it was but a short while ago that it was only with difficulty that a few hundred thousand pounds could be raised. Now they dealt in millions, and capital flowed into the industry in almost embarrassing volume. Every electrical issue of any importance was nowadays over-subscribed almost before it was opened, and it was reassuring to know that the confidence in the industry was not inspired by fortuitous circumstances but by hard fact. Prior to the war the number of units generated in Great Britain by electricity supply undertakings was only 2,000 millions per annum, while for 1922 it had grown to 4,572 millions. Bearing these facts in mind one could readily realise the enormous additional demand there would be on the stations when trade revived in this country. Now was the time to push on with construction works, such as the electrification of railways, civil engineering schemes, the erection of power stations and the opening up of new distributing areas. This should be done during the present period of slack trade, not only in order to relieve unemployment, but to increase our facilities for transport and to cheapen manufacturing, so that when trade revived, when Europe again came into the market and we found ourselves once more face to face with foreign competition, we should then have lower railway rates, the best of transport facilities, and a cheap and abundant supply of electric power.

The usual business was transacted, including the re-election of the executive committee *en bloc*, and a general discussion took place.

INDUSTRIAL RESEARCH.

Electrical Engineering Development.

By W. WILSON, B.E., M.Sc., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

DURING the past 40 years, radical changes in manufacturing conditions have rendered industrial research essential for the attainment of reasonable efficiency and progress. Industrial research is divisible into two orders, the more general and the more particular, both being necessary for the production of a new article. The second is usually termed "Development," and is the special subject of this paper.

While British men of science and applied science have been pre-eminent for general research, little attention has been paid to development. Hence few inventions have, within recent years, been brought to their conclusion in this country, as compared with the great amount of original scientific work which has been successfully accomplished. The reason for this can be traced to lack of the co-operation necessitated by modern manufacture. This want is filled by development departments.

The function of the latter is to evolve new types of product for manufacture in the shops with which the department is associated. This also involves the evolution of new parts for an existing model, to endow the latter with new characteristics or to improve it in some desirable respect. In many cases the designing and drawing offices may themselves be able to effect a desired change, and merely require certain theoretical or experimental information which is supplied by the development staff. Problems requiring higher mathematics will be submitted to it for solution. Problems and difficulties in the examination of the finished product will be passed on by the routine testing or inspection departments. Technical advice will also be afforded to any part of the factory when desired.

The general effect of such a department is to take upon itself all technical burdens from the shoulders of the staff and works. It thus incidentally performs two very important services. First, much of the worry and risk of failure is removed from the designing staff, and, secondly, all work of a non-standard nature can be removed from the shops, as the model makers attached to the development department carry out all experimental or tentative construction. The aim of the development system is to put an end to the absorption of time and disarrangement of routine caused by the sandwiching of trial jobs between the regular items of work, and by the frequent visits of draughtsmen to the work benches, and to enable both shops and staff to pursue their duties with a minimum of interruption.

In order to illustrate the above curriculum and to demonstrate its general applicability, the author outlines the actual work to be carried out in two specific cases, so selected as to represent opposite extremes.

In the case of a factory employing several thousand hands, all engaged on mass production, suppose that the designs are supplied by customers, as was the case with munition firms during the war. The peculiarity of such works is that there is no apparent necessity for any theoretical department, if a materials test-room be excepted, and it is by no means unknown for a factory of this nature to be organised with no special provision for technical knowledge.

Yet there are frequent problems, even in repetition work, that require solution by a highly trained man. Keeping the factory as a whole just as it is, an immediate gain in efficiency out of all proportion to the cost would be effected by the institution of a small development department, the chief duties of which would be to act as consultant to the shops and suggest, or search for, scientific methods of overcoming the many small difficulties that crop up.

The second example is a department associated with an electrical factory, which is entirely self-contained, in that the whole of its products are designed within its walls. The development staff will endeavour to produce new designs of apparatus for the shop to manufacture. Much of this work will be undertaken as a result of representations from the various sales, design, works, or other departments. It will also keep in close touch with electrical practice, and will thus itself be able to initiate proposals as to future activities. These will be submitted to the management through the medium of reports.

Since the development department is either the point of origin or the clearing house for new products, it must be the repository for all technical data concerned in the design of the articles made in the factory. It would be absurd to assume that no member of the regular office or works staff is capable of introducing original improvements or novelties, and it is perhaps scarcely necessary for every single item of experimental design to be made up in the development shop. But it may be stated emphatically that if the department is to be efficient it must know the whole truth with regard to the design and performance of all the products for which it is responsible. Draughtsmen and foremen are exposed to a natural temptation to experiment for themselves. This procedure re-introduces non-standard work into the factory curriculum; it is a most expensive practice, and an efficient and economical outlet for such energy is now provided. Such people should be instructed to communicate their proposals to the development department, and any attempt at "private enterprise" should be strictly repressed.

Careful records and an index of information bearing on subjects connected or allied with those under investigation must be created, preferably on the card system. These records render the development staff fully capable of acting in a consultative capacity to the factory in general, and of dealing with a wide variety of technical queries. Calculations involving higher mathematics and questions involving theory will be addressed to the department. Test-apparatus for given requirements will be specified, designed, or even constructed for the routine test-rooms. Inquiries, even of the "workshop recipe" type, may be made and answered by means of an appropriate index. When a complaint is received from a customer the development department will act as an adjudicator for the firm, bestowing the blame in the right quarter and proposing a remedy.

The examination of materials comes, in reality, within the scope of routine testing; but as such work is of small extent, and requires expensive and delicate apparatus that is also necessary for development work, an exception may be made in this respect, and such routine work may be done in this department. The same arguments apply to the calibration of instruments, but routine work is out of place in a development laboratory, and its introduction is most undesirable.

From the above functions it will be seen that a very considerable burden is removed from the works and drawing office, and the result must be smoother and easier working, economy of labour and certainty of result.

The development department is the correct place for examining suggestions from outside its own walls. The benefit derived from this source is, however, much less than is generally imagined. If it were more fully realised that discoveries can be made only by people who are earnestly searching for them, and who also know from long experience how and where to look, much disappointment to would-be inventors, and much loss to the investing public, would be saved.

The person whose suggestions are likely to prove of value is the one who is actively engaged in producing or otherwise dealing with the article in question. Such proposals from the shops as are acceptable are usually for improvements in methods of working, and for safeguarding the operators themselves from injury. The author is in favour of stimulating the workpeople by the standing offer of a monetary reward when such suggestions are used. Outside the factory, suggestions are offered chiefly by customers and patentees. Even when a suggestion is sound it is not always possible to employ it at once, as the modification of the standard design will not always be justified for the sake of a single improvement. Such suggestions are therefore carefully filed for use in the immediate future.

The preceding remarks will have emphasised the value of a development staff able to collaborate upon special functions, unimpeded by commercial matters, or the regular routine work of the factory.

Although it is probably going too far to assert that the research man's qualifications can be conferred by any course of study upon an individual who is not specially gifted by nature, it is a fact that they can be enormously stimulated by appropriate training. In the case of one who hopes to attain a leading position in technical research and to exercise the functions that have been described, the following preparation is indicated:—

General training in (1) the art of clear and logical thinking, afforded by the study of mathematics; (2) the tactics of research, afforded by a study of physics and chemistry and, if possible, of geology; (3) the art of lucid expression, afforded by the study of languages; (4) for the hand and eye, afforded by the study and practice of mechanical drawing; (5) the practical application of theory, afforded by works experience as nearly concurrent with the theoretical training as possible.

Special training* in advanced study of the (1) principal pure science concerned in the industry (electricity and magnetism); (2) applied sciences bearing on the subject (at least applied mechanics, mechanics of machinery, theory of structures, strength of materials, and heat engines); (3) professional subject concerned (electrical engineering); and (4) practice in design (electrical design).

The pure science subjects the author considers to be especially valuable for the purpose in hand.

The necessary works experience after graduation should be obtained preferably as a regular employé, and not as a privileged hanger-on. In addition, the inspection of works concerned with collateral industries is especially valuable as an antidote to a "water-tight compartment" tendency that frequently cramps development.

A development department exists to relieve the rest of the factory of worry, and every care should therefore be taken that ordinary worries, such as "chasing" materials and plant, are spared it. Secondly, "rush jobs" should be given to it as sparingly as possible, for the process of obtaining inspirations to order may be a very exhausting one, especially if those concerned be already fatigued or concentrating at the time on some other problem. Thirdly, the data should be accurate and, if possible, first-hand. Finally, due appreciation should be accorded to the work when it is done.

The method of evolving a new product comprises study, consideration, sketching the resultant design, making the model or fuller drawings, and testing the model; followed by modification of the design and re-testing as required. One very important rule is a corollary to the principle of analysing a problem into its constituent parts and attacking these separately; and enjoins a policy of breaking up a course of development into a series of steps, each representing a difficulty to be overcome, and of performing them seriatim. The quickest progress is made by constructing a series of models, each achieving some definite result and overcoming some difficulty of design. This process is analogous to the life history of any fully developed apparatus, such as the electric tramcar, the first of which was simply a horse car with motor and controller attached; the first rough model that afforded data for the more perfect types.

Buildings and equipment, the recording and filing of results and data, and the indexing of literature and information are discussed; the principal industrial research organisations in Great Britain are briefly summarised, and a short discussion on co-ordination concludes the paper.

Discussion.

An interesting discussion was opened by Mr. A. P. M. Fleming, who thought the paper an opportune one. There was need for consistent development and the removal of all experimental work from the factory, but he was not quite sure about the functions of the department as outlined by the author. Might it not be rather confusing to adapt his methods in the case of all kinds of general electrical manufacture, or did he intend them to be applied only in the case of certain kinds of products? The reference to staff was one of the most important features of the paper; personally, he preferred University men who served some time in the shops before entering the research department. Although the qualifications of the staff should be high, the standard suggested by the author were too high. Could he give some idea of the amount of money that should be spent on such a department? He found that at least 3 or 4 per cent. of the turnover should be allocated to that purpose regularly if consistent results were hoped for.

Mr. E. B. Wedmore pointed out the fact that the development engineer brought money to the firm employing him. In the paper, he thought, more emphasis should have been placed upon the engineering than on the scientific side. The development man should be given every opportunity to thoroughly familiarise himself with the works point of view, and with cost sheets; far too much had been made and put into production in the past without having been adequately tested beforehand because of the lack of facilities for doing so. Concerning co-operation, not only teamwork, but also co-operation between competitors should be enlarged, because the country that neglected that aspect would be left behind. If they had co-operated to enable cables, transmission-line poles, switches, &c., to be adequately tested in the past, they would have been made and used differently to what they were to-day.

Mr. W. B. Woodhouse explained that what was required to carry out research was not money and a laboratory, but incentive—and that was reward. Co-operation was lacking because of the fear of not receiving a fair share of the reward. The electrical manufacturer had as a customer the expert user and, as a great many developments were due to the suggestions of the user it was logical to take the latter into consultation. If the universities were also taken into council, it would be beneficial to both professors and students.

Dr. C. C. Patterson thought that the author had tried to prove a little too much in his paper. For the development of some types of product his system was alright, but it could not be applied to all sections of industry. There was no universal rule for the system and scope of a development laboratory; in many cases it was works processes rather than models of gear that had to be investigated. He disagreed with the sequence of events between the genesis and application of a piece of apparatus as described by the author and, with regard to the type of man required for the work, industry would produce only very mediocre results if it relied solely on the universities. One must discriminate between research and development, but they could not be entirely separated. It was impossible to develop all the time without at the same time gaining new knowledge; without the latter they could not progress.

Mr. E. T. Williams said that the fighting services realised during the war that the problems they encountered could not be solved without experiment, and the tendency to sweep away all such work after the Armistice had been found to be impossible. If success was to be achieved the two sections, *i.e.*, research and development, must be treated as separate parts of one organisation. If they took the trouble to find them, men could be obtained who would carry out team work without losing their individuality, but it was necessary to give each man credit for his own work. With regard to the staff of such a department, what was needed was a balance between the scientific, practical, and administrative, avoiding an excess of any one. In the naval dockyards the system of making awards to workmen for suggestions was found to be successful, and it encouraged the men to take greater interest in their work. If an invention or new device were submitted to the criticism of an independent man who had had no connection with its previous history, he could generally suggest improvements, particularly with regard to the reduction of parts.

Mr. S. W. Melsom explained that some of the observations he had intended to make had been anticipated by previous speakers. He thought it would be irritating to divide the development of an article into several stages as suggested by the author, and pointed out that what the author described as the standard method of testing fuses was not the standard method. He had hoped that the old remarks about university men would have been avoided, but the scientific worker would not assume the position he should do until it was realised that he was a human being; he certainly would not be human if the author's ideas were followed.

Mr. F. Creedy wanted to know who was to decide what was new apparatus, and could they be sure that when it was developed technically it would be successful commercially? Commercial men were eager for research, but their reluctance to embark upon it was due to their being puzzled as to the outcome of the development. The development engineer should be a close student of application and should co-operate with the commercial side; moreover, he did not realise the sales difficulty. A standard product sold itself, but a newly developed article needed to have its advantageous features intelligently explained to the prospective purchaser. Initially, no one could do that except the development engineer himself, and it would take time for the sales organisation to become sufficiently acquainted with the new article in order to sell it efficiently. Purchasers often stated that they would give almost anything for a certain type of apparatus, but when it was offered to them at a slightly higher price than that of the standard article they would have nothing to do with it.

In view of the lateness of the hour, the author reserved his reply to the discussion for publication in the I.E.E. *Journal*.

*The subjects given in brackets are those appropriate for electrical engineering development.

THE MOTOR-CAR SHOW.

The International Motor-Car Exhibition, organised by the Society of Motor Manufacturers and Traders, Ltd., is one of London's most popular shows. The seventeenth of the series is being held this week at Olympia and the countries represented include Great Britain, France, Italy, America, Belgium, and Holland. It is the first post-war car show to be held under one roof, the total number of exhibitors being about 526; yet many members of the industry were unable to secure space for the display of their products despite the fact that the new hall adds 65,000 sq. ft. of stand area, bringing the total accommodation up to 170,000 sq. ft., excluding the visitors' circulating avenues. This is not surprising when it is realised that there are some 14,000 manufacturing and allied firms in the trade, and that the Ministry of Transport's returns show that on August 31st, 1923, the number of motor vehicles in respect of which licences were current was 1,105,000, including 384,000 cars taxed on h.p., 430,000 cycles, 173,000 commercial goods vehicles, and 86,000 motor hackney vehicles, which shows an increase of 22 per cent. of private motor carriages, as compared with last year.

Again this year the only cars of direct electrical interest are the three exhibited by the Magnetic Car Co., Ltd. They are 15.9-h.p., 4-cylinder examples, the engine bore being 80 and the stroke 130, fitted with single-sleeve valve, pump water circulation, B.T.H. magneto and S.U. carburetter. No gears or clutch are employed, and the Entz electrical transmission system enables "infinite" variable speeds to be obtained, a spiral bevel final drive being used. Internal expanding brakes are fitted to the rear wheels only, while an electric brake operates on the transmission system. The engine-starting and car-lighting gear is self-contained in the transmission unit.

The electrical exhibits are all to be found in the accessories sections, but while most of the well-known makers of such parts are exhibiting, the number of general dealers is smaller this year. In view of the opinion of Mr. Gordon England, the racing motorist, that coil ignition is now coming into more general use, it is of interest to note that 104 types of car on view are fitted with magnetos only (one maker providing two magnetos for each car); 24 makers use coil ignition only, while six fit both a coil and magneto; and seven others either as desired.

Electric lighting and starting apparatus is now practically a standard component of all types of car, only a dozen or so small examples being noticed at the show that had electric light only. Belt-driven dynamos gave some trouble in last year's cars owing to the slipping of the belts; the provision made for adjusting belts could, in some cases, be made simpler, while there are gear-driven models for those who prefer them. In the case of many 1923 small cars—and some big ones—a defect was that the batteries were not large enough to meet the whole demand of a modern car. In this respect a considerable improvement has been noticed latterly.

The following firms are exhibiting:—

Chloride Electrical Storage Co., Ltd.—Exide batteries for lighting, starting, and ignition of motor-cars in a variety of sizes; hand lamps and portable accumulators, ebonite and celluloid boxes, vent plugs, plates, separators, and other parts.

British Lighting & Ignition Co., Ltd.—The new electrolytic dynamo and battery regulator which was recently described in our columns; lighting, starting, and ignition sets for light and medium-powered cars; magnetos and a selection of B.L.I.C. accessories, &c.

Forward Sparking Plug Co.—Amongst other things, plugs in extensive variety; the latest design being the type "B," which has a centre electrode of solid pure nickel running right through the plug.

Messrs. Alfred Graham & Co.—Electric horns, including the "Sparton" motor-driven type; horn push-buttons and dimmer switches; and "Motorphones," used for communication between the passengers and car driver.

Messrs. C. A. Vandervell & Co., Ltd.—A range of automobile electrical productions, embracing lighting, starting, and coil ignition systems, such are now available with both separate and combined machines; also flush fitting switchboards for lighting, dimming, starting, and ignition controls with lock switches; road lamps with concealed wiring, pedestal and flange fixings, combined head and side lamps and wing driving lamps. The lamp ranges include black celluloid finish, as also the prismatic diffuser glasses. Accessories include dash, interior, instrument and inspection lamps, batteries incorporating threaded-rubber plate insulators, lamp bulbs, sparking plugs, and spotlights or miniature dashboard searchlights.

Messrs. G. D. Peters & Co., Ltd.—Wilson electric welding plant and examples of welded repair work amongst other things.

The M-L Magneto Syndicate, Ltd.—Magnetos of many patterns for light and medium cars, impulse starters, "Maglitas," and magneto generators.

Fuller's United Electric Works, Ltd. — "Sparta" batteries and parts, portable hand inspection lamps, and cable for automobile work, rubber-covered and brass or aluminium armoured.

Messrs. Brolt, Ltd.—Lighting and starting equipment, coil ignition gear, switchboards, cut-outs, lamps, batteries and sundries.

Messrs. Powell & Hammer, Ltd.—Lamps, switchboards, and general accessories.

Messrs. Howes & Burley, Ltd.—Lamps, "Megahorns," and other electric horns.

Messrs. A. Pickard.—"Saga" magnetos, Paris Rhone lighting and starting equipment, and electrical accessories, including "Cicca" horns.

Messrs. North & Sons, Ltd.—Magnetos, speedometers, clocks, counters, &c.

Sir W. H. Bailey & Co., Ltd.—Portable electrically-driven air compressor, &c.

Messrs. Peto & Radford (Proprietors: Pritchett & Gould and E.P.S. Co., Ltd.).—Batteries and accessories, including "Dagenite" one-piece containers, and portable hand-lamps.

Societe Anonyme pour l'Equipement Electrique des Vehicules.—S.E.V. magnetos, lighting and starting equipment, batteries, cables, &c.

Messrs. John Shaw & Sons.—"Thor" portable electric tools for drilling, reaming, grinding, &c., driven by Burke universal motors.

A.C. Sphinx Sparking Plug Co., Ltd.—Sparking plugs of many sorts and tools, such as plug cleaners, &c.

Messrs. Shaw & Kilburn, Ltd.—Spot and emergency lamps, electric clocks and horns, and the "Visionator" electric screen wiper.

Runbaken Magneto Co., Ltd.—Ignition accessories, battery chargers, batteries and "testers" for them, night "stop" signal device, &c.

Benjamin Electric, Ltd.—Electric horns, push button switches, &c., and the Anderson "Autoreelite," or windscreen spot light that can be removed from its bracket and used as a table lamp.

Delco-Remy, Ltd.—Lighting, starting and ignition equipment.

Messrs. J. A. Ryley.—"Vita" sparking plugs, switches, small interior lamp fittings, carbon brushes and other electrical accessories.

Fabbrica Italiana Magneti Marelli.—Magnetos, ignition coils, dynamos, sparking plugs, &c.

Champion Spark Plug Co.—Sparking plugs and cleaners.

British Thomson-Houston Co., Ltd.—Magnetos, impulse starters, dynamos, &c., and "Genelite" oil-less bushes for bearings.

Messrs. H. H. Powell & Co., Ltd.—"U.S.L." batteries of various sizes, which are made with machine-pasted plates.

Messrs. Siebe, Gorman & Co., Ltd.—Lead hydrate accumulators.

Messrs. Klaxon, Ltd.—Electric horns.

Lucas Electrical Co., Ltd.—Lighting and starting sets, magnetos, dynamos, lamps, switchgear, &c.

Lodge Plugs, Ltd.—Sparking plugs of assorted patterns.

Rotax (Motor Accessories), Ltd.—Lighting, starting, and coil ignition devices, batteries, switches, lamps, &c.

The Cooper-Stewart Engineering Co., Ltd.—Electric warning signal devices, lamps, &c.

Simms Motor Units (1920), Ltd.—Magnetos, flexible couplings, electric horns, spare parts, and the "Hiwaylite" lighting set for use without an accumulator.

The Neale Magnet Construction Co., Ltd., shows Kendrick electro-magnetic inspection lamps, portable lamps, and tool finders, as well as other electro-magnetic appliances.

In addition to those mentioned above several firms are exhibiting general electrical accessories, and the Moonbeam Engineering Co., Ltd., shows "non-dazzle" head-lamps having a reflector of special design, an obturator bar and a lens, which function in combination so as to impart to the beam of light a sharply defined upper limit along a horizontal plane, the region above being in darkness, while immediately below is a region of intense light. The beam is always below eye level. It is spread laterally through a considerable angle, and is of graded intensity, so as to illuminate objects on the road and the hedges or paths, to the necessary degree.

The Electricity of Eels.—According to a correspondent of the *Daily Express*, experiments are to be made at the New York Zoo with a view to ascertaining the mechanism whereby the electric eel is enabled to administer shocks to other animals. Hitherto the current produced has not been successfully measured, because the shock is over within a small fraction of a second, and no apparatus of sufficient responsiveness has been used for the tests. Mr. G. T. Fielding has written to the General Electric Co. describing the problem and asking for a set of instruments of extreme delicacy. He will try, after having measured the eel's voltage and amperage, to connect it with an electric bulb and turn the current into flashes of light. The eel has given painful shocks to attendants pouring water into the tank.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Eversheds Radio Generator.

Messrs. Eversheds & Vignoles, Ltd., Acton Lane Works, Chiswick, W.4, the makers of "Megger" testing sets, need no introduction as producers of small high-grade generators of pressures up to 1,000 volts. When designing the machine illustrated below, fig. 1, special attention was paid to the requirements of radio-telegraphists and telephonists for a reliable source of high-pressure current, free from objectionable ripple and the consequent humming which it sets up. With the aid of this generator it is claimed to be possible to obtain transmission results comparable with those given with the use of h.p. batteries; moreover, with properly-designed transmitting apparatus, smoothing devices may be dispensed with. That is to say, unless the circuit has resonant characteristics of commensurate frequency, the ripple will be quite unnoticeable. Careful arrangement of the commutator segments, the distribution of the magnetic flux between the pole-pieces, and the design of the armature, has enabled the makers

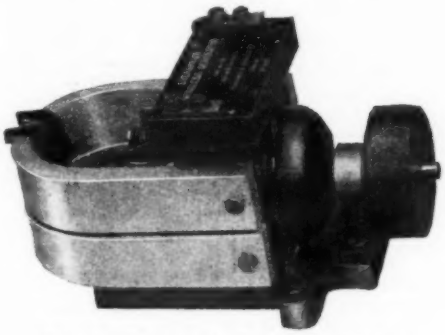


Fig. 1.—Eversheds Radio Generator.

to ensure that the currents from the armature coils, when superimposed, will give a steady uni-directional current quite suitable for radio transmission. So far as mechanical construction is concerned, the general lines of the Megger generator have been followed. For instance, the special form of commutator and brush-gear which characterises the Megger has been adopted, whilst the armature spindle is mounted on roller bearings and may be run for prolonged periods without attention.

Two types have been standardised; in the hand-driven unit, a spur gear reduction with a ratio of 27 to 1 is interposed between the driving handle and the spindle, with a ratchet gear to prevent rotation in the wrong direction. The ratchet drive also serves another useful purpose in that it allows the armature to over-run the handle if the latter is suddenly slowed down or stopped, thus preventing damage to the machine. The belt-driven type may be run by a small motor, 1/10 or ⅛ h.p. being ample, connected to a lighting circuit, and to ensure that the best results are obtained, the makers

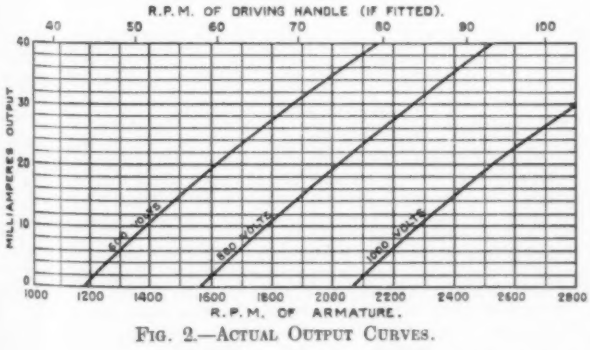


Fig. 2.—Actual Output Curves.

are prepared to supply belts of the most suitable form. Both types of generator are built to give outputs of the order indicated on the curves reproduced in fig. 2. They may, of course, be much more heavily loaded, but overloading, if excessive, is attended by imperfect commutation.

In the hand-driven type an insulating strip is fixed on the crank handle to prevent body-capacity effects through contact of the knuckles of the hand with the metal crank. This type of machine weighs 10 lb., is 11¾ in. long overall, 4½ in. wide, and 4½ in. high, while the belt-driven type weighs 9lb., is 8¾ in. long, 4¾ in. high, and 4½ in. wide.

New B.T.-H. Radio Valves.

The great drawback attendant upon the use of valves in wireless receiving has been the necessity of having accumulators to heat the filaments. Tungsten, a refractory metal, will emit about 0.3 amp. per sq. cm. at a temperature of 2,500 deg. absolute. With thorium, however, at a lower temperature, the emission is many thousandfold that of tungsten, and this fact has enabled the British Thomson-Houston Co. to produce its type B.5 valve, which is now being manufactured at the Rugby works. A layer of thorium is deposited on the tungsten filament surface, the result being a valve requiring but one-fifteenth of the wattage to heat its filament that is required by what is generally known as the "R" valve. The latter requires about 2.6 watts heating energy, *i.e.*, about 0.65 amp. at 4 volts. The new B.5 valve, however, requires but 0.18 watt, or 0.06 amp. at 3 volts. This at once makes it a practical scheme to dispense with accumulators, their place being taken by dry batteries of reasonable size, which will supply the current needed for two or three of the new B.5 valves for several weeks of intermittent duty. While taking

Fig. 3.—New B.T.-H. Type B.5 Valve; Filament Consumption, 0.06 A at 3 V.

Fig. 4.—B.T.-H. Type B.4 Amplifying Valve; Filament Consumption, 0.25 A at 6 V.

this exceedingly small filament energy, the B.5 valve is an improvement over the average "R" valve as regards the important constants of voltage amplification factor and anode resistance. As a detector, when used with from 20 to 40 V anode voltage, and as an amplifier with from 40 to 80 volts, it gives excellent service.

Another new receiving valve of larger size and power is known as the B.4. Its filament consumes 0.25 amp. at 6 volts. This valve is designed so as to have a low anode resistance and high amplification factor. It gives excellent results both as a detector and amplifier, but is particularly suitable for use in all sizes of amplifiers, especially those used with the largest size of loud speaker. An anode voltage up to 100 is satisfactory.

The illustrations, figs. 3 and 4, show the new valves; both are fitted with the standard four-pin cap, thus avoiding adaptors with the increased liability of noisy operation due to additional contacts.

The "Utility" Duplex Current Limiter.

The "Utility" current limiter, made by Electrical Utilities, Ltd., of Tudor Works, Park Royal, London, N.W.10, which has been on the market for three years, has been adopted by seven supply authorities in the London area alone, as well as on an increasing number of provincial and colonial supply systems. It has, however, been found that many consumers desire to use some electricity for other than lighting purposes, such as ironing, boiling small kettles, hair drying, and similar purposes. As a rule the current limiter installed is not of a large enough capacity to allow of the use of such apparatus, and as a consequence current-limiter consumers have so far not only been deprived of the use of electrical appliances, but also of the benefits of being able to use current for non-lighting purposes at a reduced rate.

The "Utility" duplex combined lighting and heating current limiter (patent applied for) overcomes these objections. It will be seen from fig. 1 that it consists of a base plate on which are mounted two standard "Utility" current-limiter elements, and also a change-over switch. These elements are interconnected with the switch in such manner that one element controls the lighting circuit and the other element a non-lighting circuit. The switch handle projects through the cover of the instrument, and the consumer can "change over" as he may desire. As the two circuits are independent

of one another, it will be seen that if the consumer switches over to the lighting circuit he cannot use any heating or power apparatus. Alternatively, if he switches over to the non-lighting circuit he cannot obtain any light. Thus for all practical purposes the instrument prevents the use of heating apparatus and the like during lighting hours, and it is, therefore, practicable to let the current-limiter consumer use considerably more energy for heating purposes than for lighting purposes. If a consumer contracts for, say, a maximum current per 1 ampere for lighting purposes, the heating circuit element can be calibrated to allow of the passage of, say, 2 or 3 amperes, or any other reasonable amount which may be required.

FIGS. 5 & 6.—THE "UTILITY" DUPLEX CURRENT LIMITER, WITH AND WITHOUT COVER.

A DISCONNECTING SWITCH FOR 220,000 VOLTS.

AN article by Mr. Frank P. Lawler in the *Electrical World* points out that factors which are practically negligible in the design of 110,000-volt switching stations become of paramount importance in the design of stations for 220,000-volt operation. Probably no item in conjunction with the electrical system development of recent years has increased in greater proportion than the expense of the high-voltage outdoor switching station. For switching a double-circuit line the space requirement during this period of development has increased from a few thousand to more than a hundred thousand square feet.

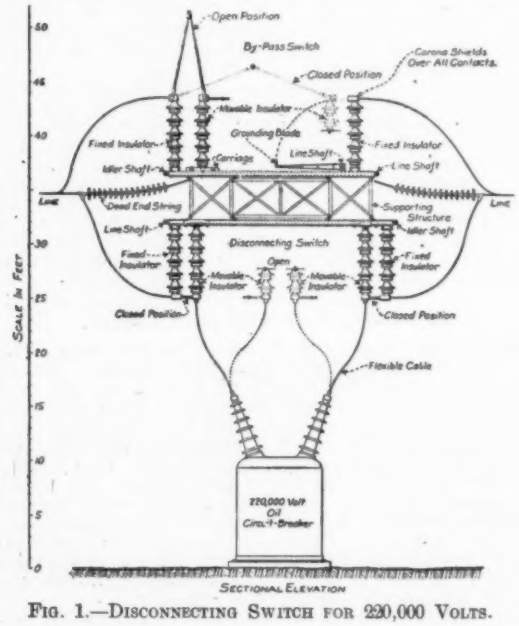


FIG. 1.—DISCONNECTING SWITCH FOR 220,000 VOLTS.

In designing the 220,000-volt generator switching station at Pit River and the Vaca-Dixon receiving sub-station on the 220,000-volt system of the Pacific Gas & Electric Co., an endeavour was made to develop a switching scheme which would possess all the qualifications of safe operation combined with minimum cost and an absolute minimum space requirement. This work was done in the office of Frank G. Baum, consulting hydro-electric engineer, of San Francisco, under the direction of Mr. Lawler.

The accomplishment of the object in view was principally due to the development of a new type of disconnecting switch, radically different from anything used heretofore. The main requirements taken as the basis for the development of this switch were:—

1. To obtain a switch in which there would be no tendency to change its setting through the influence of gravity following the mechanical failure of any part.
2. To obtain a switch in which all opening or closing motion would be in a vertical plane through the line conductor, therefore requiring no extra clearance for its installation in the line.
3. To obtain a switch which could be mounted above or below with equal facility and which could readily be equipped with an earthing blade.
4. To obtain a switch which had no long blades rotating in a horizontal plane and hence requiring extra separation between the several phases, and having no long blades opening in a vertical plane, necessitating large overhead clearances.

The principle of operation and general form of this 220,000-volt air-break switch are shown in fig. 1. Over each oil circuit breaker is provided a double-break disconnecting switch which disconnects both terminals from the line. Above the disconnecting switch is mounted a single-break by-pass switch which allows the line to be kept in operation when the oil circuit breaker is disconnected for repairs or inspection. The readiness with which the operator or workman can see if the line is open or closed is an important feature of this design and imbues the workman particularly with a sense of safety.

The by-pass switch consists of three insulator pillars, of which the two outer are fixed, the centre one being movable in a trackway. The movable insulator is connected by a toggle to one of the stationary pillars. This toggle is literally a section of the line which is "lifted" out of place or "lowered" into place by the movement of the centre insulator. The operation of the three poles simultaneously is accomplished by the rotation of a line shaft at one end of the trackway. The line shaft is connected to the carriage of the movable insulator by means of a sprocket and endless chain. A grounding blade, which short-circuits one of the fixed insulators, is provided and is operated by a separate line shaft as shown in fig. 1.

The disconnecting switch consists of four insulator pillars, the two outer ones fixed and the two centre ones movable on carriages. The control is by means of a line shaft similar to the by-pass switch, the rotation of which causes the movable insulators to move simultaneously in opposition to one another to and away from the contacts on the fixed insulators, as shown in fig. 1. Thus the contact is made and broken at two points. Flexible cables connect the contacts on the movable insulators to the oil circuit-breaker terminals as shown in fig. 1.

The three horizontal line shafts which operate the by-pass switch, the disconnecting switch, and the grounding blades are extended to the supporting columns, where by means of bevel gears they connect to vertical riser shafts which drop to hand-wheel controls suitably located above the ground. The three controls are provided with locks in both open and closed positions.

These switches were built by the Pacific Electric Manufacturing Co., of San Francisco, and are now installed at the Vaca-Dixon sub-station of the Pacific Gas & Electric Co.

OUTDOOR OIL CIRCUIT-BREAKERS FOR 44,000 VOLTS.

Ferguson, Pailin Products.

CONSIDERABLE attention is being devoted at the present time to the problem of reducing the capital cost of sub-station equipments necessary for drawing supplies of electricity from e.h.p. transmission lines. One solution is to build the transformers and oil circuit-breakers suitable for mounting out of doors, thus eliminating building costs.

Apparatus of this type has only a limited application in this country, but suitable designs have been developed and supplied by British manufacturers, mainly for overseas trade. A typical example of such enterprise is the type of 44,000-volt outdoor automatic circuit breaker manufactured by Messrs. Ferguson, Pailin, Ltd., for service in Canada, a standard "type T" unit being illustrated in fig. 1. This particular design is symmetrically shaped to facilitate the running-off of rain, and prevent it gathering in recesses, &c. All the joints are carefully made weather-proof, and the operating mechanism is mounted under cover; the design of the bushing insulators ensures that a sufficient surface is protected from rain, or snow, to give an ample insulating creepage surface to the breaker when entirely exposed to the weather.

Each three-phase unit complete with oil weighs 2½ tons, and the provision of a 21½-in. head of oil above the point of rupture, a high breaking speed, large air cushion, tanks holding 144 gallons of oil, and a thorough venting system, has

instrumental in producing a large rupturing capacity. ey can be arranged for either manual or electrical operation automatic, or non-automatic, tripping as desired.

Three single-pole units are coupled together and mounted on s channels to form a three-phase unit. The copper ter- als carry fixed finger-type contacts at their lower ends, h steel stiffeners to ensure good contact, and easily renew- e arcing contacts are provided. The moving blades are ly screwed and pinned into bakelite connecting rods, which rate in tubular bakelite guides fitted with lignum vitae rings.

The provision of accelerating springs enables a high breaking ed to be obtained, and suitable devices retard the breaker the end of its stroke.

The tank-lowering device is of windlass type, and is so anged that any single tank, or all three tanks, can be ered by one man, and knuckle joints in the tank-supporting h enable the tanks to be withdrawn. The vents are arranged that the vapours expelled on breaking heavy powers im- e on baffles which separate the oil from the gases. The er escape through two vent pipes, whilst the oil is diverted o a well; an automatic valve seals this well when pressure ts in the tank, and opens as soon as the pressure is re- ed, permitting the oil to drain back into the tank, and s conserving the oil. The vent pipes project downwards, d are covered with mesh to prevent the entry of insects and eign matter, while a trap is provided with an external

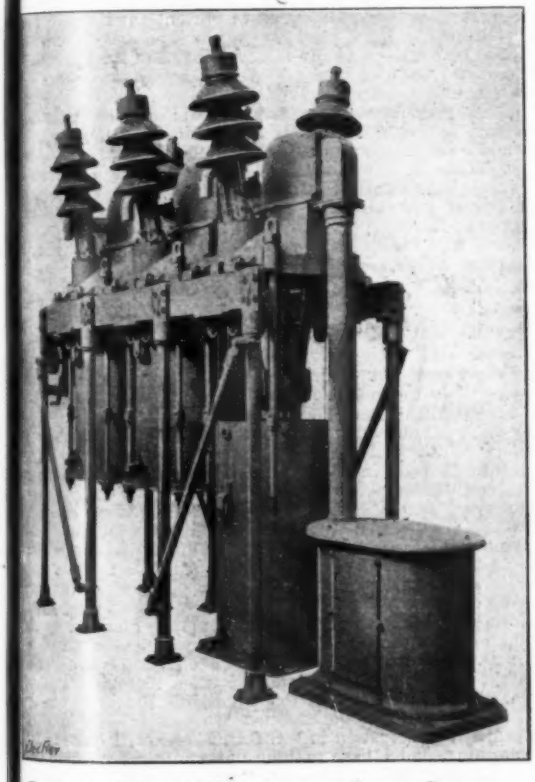


Fig. 1.—An F.P., 44,000-V, Outdoor Circuit Breaker.

ck, which prevents moisture from being blown down on to e oil.

The terminal busings are of the condenser type, and the ulating material is bakelite, around which porcelain sheds e cemented one into another; the intervening space between e bakelite and the porcelain sheds is filled in with compound. A metal cap is cemented on to the top porcelain shed to seal e end of the bushing, and incorporates a cone grip socket r the external connections.

Special attention is given to the porcelain sheds to ensure at there is sufficient creepage surface protected from rain d sleet to give security under the worst weather conditions.

A ribbed non-magnetic casting clamped on to the bakelite shing and cemented into the lower porcelain shed forms the ing to the base of the breaker, and provision is made for e mounting of current transformers on the bushing. The mplete bushing and fixed contact can be withdrawn from e breaker without difficulty, suitable registering pegs being ovided to ensure replacement in the correct position. The wer portion of the bakelite bushings extend below the oil el to prevent static effects.

The main operating mechanism is mounted under cover and elded from weather effects; it is arranged outside the eaker, and hand operation, when desired, is effected by eans of a cantilever which allows the breaker to be closed by an easy movement; electrical operation is carried out by a simple solenoid device.

CURRENCIES AND TRADE.

By HARRY ALLCOCK, M.I.E.E., M.I.Mech.E.

The title of this article may cause some readers of the Electrical Review to ask why they, as manufacturers and traders, should be expected to take an active interest in a subject which has hitherto been regarded as the almost exclusive concern of professional economists and financiers.

The prolonged trade depression, with its attendant misery and burden of widespread unemployment, have, however, induced some of our leading industrialists to challenge the competence of these financial experts to be our sole guide in these difficult times.

How often do we hear, for instance, that an export order has been lost because the would-be purchaser cannot bring himself to the point of paying a fabulous number of francs for what he describes as a few pounds' worth of goods; or again, how often are we finding our home market invaded by Continental manufacturers who, assisted by their depreciated currency, can place their goods on our own doorstep at prices below our cost of production.

To the British manufacturer, striving to keep his works open and to find work for his employés, the study of this currency question is indeed of vital interest and the demand has accordingly arisen for a simple exposition of such matters as the purchasing power of money, the processes of currency inflation and deflation, the differences between primary and fiduciary money, &c.

About two years ago Mr. Ll. B. Atkinson delivered a little-noticed address* entitled the "Economics of Trade and Production," to the members of the Rugby Engineering Society, giving as his sub-titles: (1) The Purchasing Power of Money; and (2) Foreign Exchanges and their Depreciation.

This little treatise is a masterpiece of that lucidity which members of the Institution of Electrical Engineers have learned to expect from their distinguished past president, and the present time, when the Federation of British Industries is pressing for a further examination of our financial policy by financiers *and industrialists* in joint conference, is peculiarly opportune for its perusal.

Writing two years ago, Mr. Atkinson summed up in a paragraph the problems which still confront us in these words: "Of the problems which at the moment come most home to us at every hour and every day there are two. For our homes and home business, the purchasing power of our money, and the cost of living; and in our foreign business, the problem of exchange, that is, the *relative value of our money and other countries' money* as expressed in commodities."

To the present writer the important words are those he has ventured to *italicise*, because it would appear that many of our present difficulties can be traced to the circumstances that in our efforts to return to the gold standard for the purpose of enabling the pound "to look the dollar in the face" we have unduly increased the divergence between the British currency and those of our Continental neighbours, with a result that both our home and foreign markets are placed in jeopardy.

Mr. Atkinson goes to the heart of the matter when he says "The declared policy of our Government is to diminish the amount of Treasury notes in circulation; it can only be done by diminishing unproductive State and municipal expenditure, by lowering wages, and by diminishing banking credits. These things are being done. It may be they are being done too fast, so that the adjustments are causing more economic discomfort than is wise, but at least they are becoming effective, as the rise in the value of the Treasury notes from about 13s. 3d. to 16s. 6d. relative to a gold pound of 20s. bears witness. But what of other exchanges?"

The whole question bristles with difficulties which must be overcome before a general revival of trade can even be hoped for, and it is highly important that the trading community should have a correct appreciation of fundamental principles.

It is in that direction that Mr. Atkinson has again placed the engineering industry in his debt, and his simple statement deserves to be very widely read and digested.

CORRESPONDENCE.

Letters received by us* after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Telephone Charges.

We are led to believe that the Government and its various departments are doing all they possibly can to assist commerce. One of their methods is as follows:—

Business firms, councils, or corporations taking out agreements in the Manchester district for telephones for their staff are asked to pay £2 per quarter per telephone, apart

* Although delivered two years ago, this address has not previously been published.—Eds. Elec. Rev.

from any mileage rate. If the same agreement is taken out and signed by the subscriber and not by the firm, council, or corporation, the telephone rate is £1 12s. 6d.—apart again, of course, from any mileage rate. Consequently, business firms, &c., which do this are being charged 30s. (thirty shillings) a year per telephone for the privilege of signing a telephone agreement. Some firms have realised this point, and as a result the staff have signed agreements with the Post Office Telephones and are saving 30s. a year, though the firms are actually paying the bill.

The tariff rates as published by the Post Office state that in the Manchester district the charge is:—

In premises occupied wholly or partly for business or profession, £2 per quarter.

In premises occupied as private residence only, £1 12s. 6d.

Because the contract for a telephone for a member of the staff is signed by any firm, &c., the Post Office charges a higher rate in spite of the fact that the premises are occupied as private residences only.

This may be well known to a considerable number of the community, but in times like these one cannot see the object of being charged 30s. per telephone more than is necessary on what looks very like a piece of imposition.

Why should a business telephone cost more than a domestic telephone? As far as one can judge the instruments, &c., are the same.

Bitten.

October 30th, 1923.

The G.P.O. and Electricity Undertakers.

The discussion on this matter has assumed a far more personal tinge that I had anticipated when I wrote my original article. This is to be deprecated. But there are some points in Mr. Bartholomew's article appearing in your issue of November 2nd which call for some notice from me, as the offending author of the original article. This, as premised therein, was intended as a calm examination and review of the legal powers of the Postmaster-General from what I considered to be the true standpoint, that is to say, the due protection of the Postmaster-General in carrying out his duties to the public. There was, in fact, ground for thinking that the Post Office had been seeking to extend its jurisdiction and generally stretch its powers, to the detriment of electrical undertakings, and this was the reason for such review and examination. Further grounds have since been furnished by the letter now appearing in your issue of November 2nd, from Mr. W. Fennell, M.I.E.E. If Mr. Bartholomew takes umbrage at any inference that the Postmaster-General and his department are not infallible angels it cannot be helped. Government departments are as liable to error as individuals, and are not above criticism.

Now, I never stated that the Postmaster-General was assuming responsibility for the *safety* of the public. But it certainly did appear from Mr. Bartholomew's first article that he was somewhat mixing up this question with that of the true limits of responsibility and concern of the Postmaster-General. If he now expressly dissociates that functionary from responsible concern for the safety of the public, I am quite content to accept that. As regards the question of notices, all I can do is to repeat that Section 4 of the Electric Lighting Act, 1888, does give the power to the Electricity Commissioners in certain cases therein specified (but which are probably rare), if they think fit, to serve on electrical undertakings although working under the provisions of a licence, order or special Act, a notice applying the Regulations referred to. It is not for me to say in what circumstances the Electricity Commissioners would think fit to serve these regulations. That is a matter for the Electricity Commissioners to determine.

Adverting now to the point of the misquotation of "would" for "should," this had a much more important bearing than mere proof correction. Mr. Bartholomew made certain observations which were based, and could really only have been based, on the assumed use by me of the word "would." The construction to be put on the sentence objected to by Mr. Bartholomew really depended on this use of this word, the word actually used by me being "should." It is difficult, therefore, to see where the question of correction or non-correction of the proof of Mr. Bartholomew's article comes in. If he had corrected his proof quotation by substituting "should" for "would," he would also have had to further correct the proof by striking out the whole of his reflection on my sentence.

As regards the technical questions, Sir Philip Dawson's book was, I agree, published in 1909, and not in 1905, as stated by me. The date was taken from a typed note supplied to me in which the error occurred. It, of course, does affect the calculation of 10 years' interval between the publication of that book and of Mr. Austin's book. It should be six years; but it is really quite immaterial whether it was 10 or six years. But Mr. Austin's book was published four years after Sir Philip Dawson's reply on March 14th, 1911, to Professor Jenkin, as now quoted by Mr. Bartholomew. Even Mr. Bartholomew, in his first article, said that he believed a reference by Sir Philip Dawson in one of his papers might lead one to think that the Board of Trade had approved a 20-volt drop on the rails of the Brighton Co. But Mr. Austin's book, published in 1915, at page 10, makes the distinct statement that the Board of Trade had by then fixed the maximum permissible drop in the return circuit at 20 volts in the case of alternating currents. Surely, this is capable of correction, if untrue, by other means than referring to what Sir Philip Dawson said in 1911. I have to own to a misunderstanding of Mr. Bartholomew's references to abnormal happenings, and agree that these were other than those which would arise from the use of single-wire telephone circuits, and I have no doubt that he is right in saying that the recommendation of the joint committee of the House of Lords and House of Commons on this point was based largely on evidence given by the late Sir William Preece. If there has seemed to be any lack of good advice to me on the technical side in this particular it has been my fault and no one else's. But, after all, abnormal happenings are "abnormal," and the incident referred to by Mr. Bartholomew as quoted from an after-dinner speech in 1911 must have taken place many years before 1911, and in then existing scientific conditions.

I do not desire, and my technical qualifications are really insufficient to enable me, to attempt to deal with all of the technical points made in Mr. Bartholomew's last article, but I would like to draw attention to the fact, for what it is worth, that in the model clauses inserted in Railway Acts authorising the use of electric power, the section requiring the undertakers to so construct their electric lines and works and work their undertaking as to prevent interference with the telegraphic lines used by the Postmaster-General, is qualified by exclusion of any telegraphic line of the Postmaster-General laid down or placed by him along the railway.

In conclusion, I note the statement now made by Mr. Bartholomew that if the Postmaster-General withholds his concurrence, in cases where his concurrence is necessary, it "would" be on grounds based on sound technical considerations. This is, I am sure, all that electrical undertakers ask for in this regard. They are entitled, and reasonably so, to expect it, and this has been the objective throughout of the Electrical Review.

W. H. Stoker.

London, *November 4th*, 1923.

Strictly Home Office?

For the sake of brevity I am assuming that I have everybody's permission to reduce "Technical Adviser and Chief Designer" to the simple initials "G.P.D.," and refer to his most interesting letter under the above heading, published in your issue of November 2nd, 1923. If your correspondent's brief specification of H.O. were officially accepted, my letter published in your issue of October 26th, 1923, would never have been written.

However, as the coroner neglected the medical evidence, including "sorosis of the liver," there was absolutely no denying the fact that deceased was in the act of renewing a fuse when death supervened. Further, it is a fact that a H.O. inspector's report induced the owner of the distribution board concerned to give me the order to make his board conform to H.O. requirements; and that I found it by no means easy to comply. Now assume we have a board to "G.P.D." specification installed in a chemical works, or a laundry; obviously, there is danger, when there is a P.D. to earth. Wherefore I submit that all boards should be strictly Home Office without qualification whatsoever. In spite of the printer's punctuation in "G.P.D.'s" letter, I quite follow his meaning, and I have nothing but praise for his fuse elements as such; but on his smaller size of element, the handle is too small for any hand, and in the design of a small 4-way board recently erected, the erector was terribly handicapped for space, also the cable sockets were too small for their appropriate I.E.E. conductors. However, close criticism in public is inadvisable. In many of the equipments that come before me, in my opinion, an unnecessary amount of metal is volatilised when a fuse goes. I wonder what G. P. D.'s remedy for this may be. It must be upwards of five years since I last saw a Donovan polyphase H.O. distribution board, which, in my opinion, was strictly H.O., but it embodied objectionable features to my way of thinking; but I do not think it advisable to enumerate them here. Mr. Arthur W. Cox's letter places me at a disadvantage; I can only plead guilty. Recently a gentleman said to me: "Rogers, the gear you fancy is no doubt good, but it is adjectively expensive and not competitive; you are up against hot competition."

W. E. Rogers, A.M.I.E.E.

London, *November 4th*, 1923.

A Chief Engineer's Salary.

I notice in the Personal Column of last week's Review that an engineer has been appointed to take charge of the Skipton Urban District Council electricity undertaking at the princely salary of £225 per annum!!!

It is a matter for regret that an engineer, presumably "technically trained and with previous experience in a similar

apacity," can be prevailed upon to give his services for a remuneration little better than that of a wireman.

I would also like to call the attention of the E.P.E.A. to the fact that this avenue of promotion for its members, *i.e.*, the promotion to chief engineer in the smaller undertakings, is in the way of becoming jeopardised, and I think it is a matter for the I.M.E.A. backed by the E.P.E.A. to give this immediate consideration.

A.M.I.E.E.

October 31*st*, 1923.

[Other letters to the same effect have been received.—Eds. Elec. Rev.]

The Luton Tariff.

Surely Mr. Cooke does not dangle false hopes before his consumers?

Lighting units at 0.75d!

I think that 2,184 are the normal hours per quarter, so the hope of even "1d. for the next 3,000" (hours per quarter) is rather vain!

M.

November 5th, 1923.

[Our correspondent will have his joke. The abbreviated statement in our "Lighting Notes" is perfectly intelligible; but in justice to Mr. Cooke we must say that in his tariff he duly inserts the word "units" which we, trusting to the common-sense of our readers, omitted.—Eds. Elec. Rev.]

Thoresby Colliery.

With all deference to the omni-everything of our Editor, it is respectfully submitted that the above place (as well as the Dukeries) is in Nottinghamshire, not Derbyshire, as stated.

A. Watts.

Retford, *November* 3*rd*, 1923.

Diesel-Electric Ship Propulsion.

Your leading article on Diesel-Electric Ship Propulsion, appearing in your issue of the 26th inst., has been read with much interest. Whilst several of the statements can be unequivocally conceded, there are so many misapprehensions, that I have been compelled to invite your correction of them in an early issue.

You note that out of 304 vessels presently under construction, some 49 are to be propelled by internal combustion engines. Except the other two Diesel-electric ships, the remainder will be directly coupled and will, therefore, have—in many cases—"the reversing gear very complicated, and that, not only is it a difficult matter to change the speed of the engine quickly from full ahead to full astern, but to obtain intermediate speeds, particularly very low speeds of rotation in either direction."

Is it possible that you are so much out of touch with recent work that you seriously believe that this statement is true, and that British shipowners are so ill-advised as to install such plant in their newest vessels?

I enclose, herewith, a copy of a paper read to the Institution of Engineers and Shipbuilders of Scotland dealing with the sea experience of a fruit-carrying vessel, and would call your attention to p. 41, giving some remarks made by the chief engineer of the vessel, from which it will be seen that 54 orders on the telegraph were answered in 44 minutes, a flexibility scarcely exceeded by the best steam engine.

Whilst agreeing that, generally, the low speed of propeller is desirable, this is entirely an economic question and has several factors which vitally determine it—amongst others the speed at which the vessel is to operate.

The low speed of revolution can be, and often is, very dearly bought as it involves, as you state, heavier and more costly machinery for the same duty. You further remark that many instances of breakdown have been recorded and presumably you intend this to mean defects developed in the Diesel engines.

It is well known that high-speed Diesel engines are far more prone to this than the low-speed, moderately-rated machines, and the argument against the direct-coupled system, therefore, loses its point, particularly as the electric drive usually involves the provision of multiple high-speed generating units.

With regard to the advantages obtained by cutting out one or more sets and thereby improving the load factor for reduced speeds, this is not of very serious character, because with the Diesel engine the efficiency curve is very flat, and excellent consumptions can be guaranteed down to 25 per cent. full load.* Moreover, the high-speed engine has inherently a greater fuel consumption per b.h.p., even at full load, and on this has superimposed the electrical transmission loss. Whilst for certain types of vessel a strong case can be made out for the electric drive, particularly for ships in which there is a demand for a large amount of power for some other function than propelling—*e.g.*, trawlers, dredgers, cable-steamers, &c., it can be shown that in the vessels in question a direct-coupled Diesel engine would have fulfilled all the requirements and have had considerably more advantages as to simplicity, reduction of maintenance, and probably considerably reduced initial cost.

At the same time the builders are to be congratulated on the success of their vessel, and have admirably fulfilled the owners' specification in installing what appears to be a system which is not the most efficient for the type of ship in question.

R. J. Butler, M.I.N.A.

Helensburgh, *October* 31*st*, 1923.

[With reference to the above, our correspondent has entirely misunderstood the spirit of our article if he thinks we were desirous of belittling the Diesel engine as such; our object was to indicate the particular advantages which accrue when electric transmission is used in conjunction with the Diesel engine. But our criticism regarding the complexity of the reversing and manœuvring gear is undoubtedly justified in comparison with what is required on steam reciprocating engines and steam turbines. We have had many opportunities of witnessing the trials of vessels propelled by direct coupled Diesel engines, and our own examination, coupled with conversations with the men in charge of the engines—men who have been transferred from steam ships—confirms the belief that our view is the one held by all unbiased observers. Mr. Butler's 10 per cent. of the shipowners who purchase Diesel ships is too small a minority to carry conviction, although they may be the better business men, because they are prepared to accept this and other drawbacks in view of the enormous saving in the annual cost of fuel and labour on their ships. These savings, however, with but slight modification, are obtained on the Diesel-electric ship.

With regard to propeller speed, Mr. Butler must know that the whole aim of designers at the present day is to produce an engine having a speed of rotation of 70 to 80 revs. per min., suitable for the propulsion of the 10-knot cargo ship which forms the bulk of the mercantile marine of this country. The Burmeister & Wain long-stroke engine, in fact the almost general increase in the ratio "bore to stroke," and the opposed-piston engine are all directed to this end. The Diesel-electric system achieves the same end, and simultaneously presents other valuable advantages.—Eds. Elec. Rev.]

The Fulham Strike.

Your leading article in the current issue, relative to the Fulham dispute, states very fairly the events which culminated in the "shut down" of the electricity supply, and is agreeably frank as to the party on which the onus of responsibility rests for the ultimate position.

The latter portion of the article, however, detracts somewhat from the position of fairness which the Review endeavours to adopt in matters of this description. With the number of secessions from joint boards and councils recently, particularly by municipal undertakings, and with the Halifax case still fresh in the memory of supply station men, is there any cause for wonder that suspicion exists, that there is the nucleus of an endeavour to split the various sections of the workers, in order eventually to jettison agreements, both in the trading and non-trading services?

If defensive agreements have come into being between the various trade unions, at any rate, the unions concerned are only emulating the example set by employers' federations. In considering the case of Fulham the initiative for the breaking of an agreement came, as is very often the case, from the employers' side, and the threatened breach followed by an obstinate refusal to enter into negotiations lent colour to the well-founded suspicion that each section of the workers would be attacked in turn.

Joint boards and councils, although welcomed into being, and fostered by the Government, are lacking in plenary powers to enforce findings, so that in the ultimate the workers are in the position of having their "backs to the wall," with only the economic weapon to fight with for the retention of agreements, which are framed *not* with all the advantages on the employés' side.

It may be unfortunate that drastic action was necessary at Fulham, but it may be hoped that a salutary lesson will be learned from the occurrence by other prospective defaulting municipalities.

A. Burton.

London, *November* 3*rd*, 1923.

Birmingham Lampholders—A False Suggestion.

It has been brought to our notice that our name has been connected with the paragraph which appeared in your issue October 26th, page 613, and that the suggestion has been made that considerable portions of our lampholder have been imported from abroad and have been assembled at these works.

We wish to state with all the emphasis at our command that such assertions are entirely false, and to substantiate this statement we have invited a representative of the Electrical Review to visit our works and follow through the entire process of manufacture from the raw material to the completely assembled lampholder.

Moreover, we are prepared to give the sum of £1,000 to any named hospital, providing that it can be substantiated that any

*See paper by Mr. James Richardson in *Transactions* of the Institution of Naval Architects, LXIV, 1922.

portion whatsoever of our lampholder is not manufactured in this country covering the whole period of our manufacture.

We believe we have established actual loss of business as a result of statements which we believe to be malicious, and we hope that the insertion of this letter in your columns will dispose of this matter once and for all.

pp. **Reeves & Co.**
JOHN SINGLETON.

Birmingham, *November 6th*, 1923.

[Our representative has visited the works of Messrs. Reeves and Co. at Birmingham, and has there witnessed every process in the manufacture of lampholders, with the exception of the porcelain interiors and plungers. With regard to the latter items, our representative has seen the orders placed with and acceptances from well-known British manufacturers.—EDS. ELEC. REV.]

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Patent Agents.

25,668. "Apparatus for operation of vacuum pumps in rectifier installations." Akt. Ges. Brown, Boveri et Cie. October 15th. (Germany, October 14th, 1922.)
25,672. "Vacuum tubes." F. Péri. October 15th. (France, October 7th, 1922.)
25,673. "Vacuum tubes." F. Péri. October 15th. (France, October 7th, 1922.)
25,674. "Vacuum tubes." F. Péri. October 15th. (France, October 7th, 1922.)
25,675. "Vacuum tubes." F. Péri. October 15th. (France, October 7th, 1922.)
25,677. "Closed arc lamps." General Electric Co., Ltd. October 15th. (Germany, June 23rd.)
25,678. "Tungsten arc lamps." General Electric Co., Ltd. October 15th. (Germany, May 4th.)
25,679. "Thermionic valve holder and adaptor." S. P. Storey. October 15th.
25,689. "Application of liniments, &c., by electric massage." W. H. Horsfield. October 15th.
25,695. "Sparking plugs." C. S. Swanson. October 15th.
25,697. "Braking mechanism for electric hoisting, &c., gear." British Thomson-Houston Co., Ltd., and R. D. Given. October 15th.
25,699. "Wireless receiving apparatus." J. Scott-Taggart. October 15th.
25,707. "Electrolyte for electric accumulators." A. Pouchain. October 15th. (Italy, October 14th, 1922.)
25,715. "Variable electric condensers." M. M. Melinsky. October 15th.
25,716. "Galvanic batteries." Oldham & Sons, Ltd., and W. D. Wilde. October 15th.
25,718. "Electric heating system for steam locomotives." D. Mottura. October 15th.
25,722. "Impulse circuit arrangements for telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gillings. October 15th.
25,724. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 15th. (United States, October 18th, 1922.)
26,254. "Variometers, &c." R. B. Matthews and W. H. R. Pike. October 22nd.
26,255. "Wireless receivers." R. B. Matthews and W. H. R. Pike. October 22nd.
26,260. "Wireless crystal, &c., holder." R. A. Simmons. October 22nd.
26,269. "Electric switches." J. A. Crabtree. October 22nd.
26,283. "Motor-vehicle head lamp and lock attachment." J. H. Davidson and J. Winn. October 22nd.
26,289. "System of winding multi-layer electrical coils." T. A. W. Robinson. October 22nd.
26,295. "Diaphragms vibrated by electro-magnetic, &c., means." H. S. Ryland. October 22nd.
26,309. "Wireless aerials." W. G. Read. October 22nd.
26,330. "Electric accumulators." H. M. Genese, Pritchett & Gold and E.P.S. Co., Ltd., T. Stretton, and Thor Electric Safety Lamp Co., Ltd. October 22nd.
26,322. "Vacuum tube circuits." G. H. Nash and Western Electric Co., Ltd. October 22nd.
26,323. "Telephone systems." L. Polinkowsky and Western Electric Co., Ltd. October 22nd.
26,335. "Shades for electric, &c., lights." C. Scott-Snell. October 22nd.
26,336. "Rheostats." J. R. Spink. October 22nd.
26,340. "Securing insulated parts of electrical apparatus together." British Thomson-Houston Co., Ltd., and E. B. Tuppen. October 22nd.
26,341. "Electro-magnetically operated apparatus, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). October 22nd.
26,358. "Electric switches." E. J. Erikson and H. Tillquist. October 22nd. (Sweden, April 28th.)
26,368. "Electric welding machines." N. P. Sjobring and M. Swanson. October 22nd.
26,379. "Electric lamp bulbs for road illumination." A. L. Yates. October 23rd.
26,380. "Wireless crystal clip." E. Paul. October 23rd.
26,384. "Appliance for re-magnetising magnetos." F. Ball. October 23rd.
26,388. "Production of compressed gas by electrolysis." P. Hausmeister. October 23rd.
26,400. "Head-lamps for motor vehicles, &c." P. H. Manning. October 23rd.
26,408. "Junction terminal for electrical apparatus." A. E. Bonner and A. Shrieves. October 23rd.
26,425. "Apparatus for recording and reproducing sounds." Kestraphone Co., Ltd., and F. Paton-Moore. October 23rd.
26,432. "Electric heating apparatus." *i.* J. Hancock and T. R. Hancock. October 23rd.
26,437. "Crystal, &c., detectors." J. H. Williams. October 23rd.
26,444. "Sparking plugs." R. Stephenson-Peach and J. L. Reynard. October 23rd.
26,448. "Means for applying electric power to assist steering, &c." W. H. Scott. October 23rd.
26,450. "Wireless telegraph, &c., apparatus." R. H. Johnston. October 23rd.
26,454. "High-voltage oil-immersed transformers." Ferranti, Ltd., and A. W. G. Tucker. October 23rd.
26,456. "Electric condensers." E. C. Briscoe and W. H. Briscoe & Co., Ltd. October 23rd.
26,463. "Electric circuit-controlling means." British Thomson-Houston Co., Ltd., and A. S. FitzGerald. October 23rd.
26,464. "Protective apparatus for alternating-current systems." British Thomson-Houston Co., Ltd., and A. S. FitzGerald. October 23rd.
26,469. "Magnets, electric motors, and transformers." J. Schulz. October 23rd.
26,480. "Cold-storage accumulator, &c." Soc. Anon. de Travaux Dyle et Bacalan. October 23rd. (France, November 30th, 1922.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken. The name of the applicant's patent agent, if any, will be found on the printed specification.

1922.

9,519. "Printing telegraph machines." O. L. Kleber. April 3rd, 1922. (204,923.)
10,002. "Methods of receiving in telephony by high-frequency oscillations and in wireless telegraphy and telephony." A. E. O'dell (C. Lorenz Akt. Ges. and W. Scheppmann). April 7th, 1922. (205,117.)
10,499. "Electric switches." J. B. Tucker. April 12th, 1922. (205,121.)
13,267. "Adjustable brush-rocker for dynamo-electric machines." O. T. Baker. May 11th, 1922. (205,129.)
16,301. "Galvanic cells." H. D. Nyberg. March 28th, 1922. (195,589.)
16,353. "Electric time switches." J. P. Haworth. July 24th, 1922. (205,143.)
16,716. "Attachment to valve detectors for wireless telegraphy and telephony." P. G. A. H. Voigt. June 16th, 1922. (205,148.)
18,583. "Apparatus selectively responsive to electrical call signals." Soc. Française Radio-Electrique. August 19th, 1921. (184,784.)
18,633. "Insulating devices for use in connection with wireless installations." A. Couldwell and S. L. Forbes. July 7th, 1922. (205,165.)
18,823. "Page printing telegraph machine." D. Murray. July 10th, 1922. (205,169.)
18,931. "Locking and controlling apparatus for electrical installations for motor-cars." Scintilla. July 9th, 1921. (182,819.)
19,089. "Electric lighting systems and means therefor." W. Brooke. July 12th, 1922. (205,187.)
19,113. "Vacuum tubes of the triode-valve type." A. S. Cachemaille (Westinghouse Electric and Manufacturing Co.). July 12th, 1922. (205,190.)
19,170. "Reception and amplification of radio-telegraphic signals." Ges. für Drahtlose Telegraphie. July 13th, 1921. (183,130.)
19,171. "Automatic electric selector for controlling at a distance." L. L. E. Chauveau. July 13th, 1921. (Addition to 146,336.) (183,131.)
19,183. "Electric multiplex communication." T. Oguti. December 15th, 1921. (190,442.)
19,270. "Trucks or understructures for railway, tramway, and other vehicles." A. Toms (J. G. Brill Co.). July 13th, 1922. (Patent of addition not granted.) (205,198.)
19,307. "Telephone systems." Siemens & Halske Akt. Ges. July 13th, 1921. (183,139.)
19,370. "Sparking plugs." E. J. Buckingham and S. G. Dickens. July 14th, 1922. (205,203.)
19,411. "Manufacture of thermionic valves and the like." H. St. J. de L. Donisthorpe. July 14th, 1922. (205,206.)
19,433. "Automatic exchange telephone apparatus." A. F. Wood, W. Stott, and Telephone Manufacturing Co., Ltd. July 14th, 1922. (205,208.)
19,436. "Automatic exchange telephone apparatus." A. F. Wood, W. Stott, and Telephone Manufacturing Co., Ltd. July 14th, 1922. (205,209.)
19,497. "Electric motor control." British Thomson-Houston Co., Ltd., and R. D. Given. July 15th, 1922. (205,215.)
19,528. "Sparking-plug tester with combined measuring gauge." G. W. Humphry and E. R. Humphry. July 17th, 1922. (205,218.)
19,806. "Filament resistances for thermionic valves." A. P. Welch. July 19th, 1922. (205,223.)
19,842. "Insulating devices for use in connection with wireless installations." S. L. Forbes. July 19th, 1922. (205,227.)
20,737. "Burglar alarm systems of the closed-circuit type." G. B. Carpenter. April 5th, 1923. (205,251.)
23,492. "Attachments for telephone receivers suitable for use in wireless telephony." B. Bryan and B. N. B. Wireless, Ltd. August 30th, 1922. (205,282.)
23,910. "Electric lamp holder suitable for stiff wires or flexibles." M. Endean. September 4th, 1922. (205,287.)
24,686. "Wireless receiving apparatus." G. Betjemann & Sons, Ltd., and H. V. Andrew. September 12th, 1922. (205,296.)
24,821. "Locking devices for use, for example, on electrical apparatus." British Thomson-Houston Co., Ltd., and J. Sugden. September 13th, 1922. (205,298.)
25,721. "Wireless receiving sets." Western Electric Co., Ltd. March 30th, 1922. (195,589.)
25,980. "Rotors for dynamo-electric machines." Dayton Engineering Laboratories Co. July 6th, 1922. (200,469.)
26,604. "Electric conductor terminals or connectors." British Thomson-Houston Co., Ltd. (General Electric Co.). October 2nd, 1922. (205,316.)
27,000. "Electromagnets." H. J. Norballe. October 5th, 1922. (205,325.)
27,592. "Caps for incandescent lamps and the like, containing condensers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 27th, 1921. (187,957.)
27,757. "Apparatus and method for repairing broken trolley wires of electric cranes, tramway and other electric wires, especially where contact is made by means of a travelling pulley." J. W. Waddington. October 13th, 1922. (205,336.)
28,238. "Electric plug socket." H. Baron (F. Aldendorff). October 17th, 1922. (205,341.)
28,937. "Electric cables." Siemens & Halske Akt. Ges. October 25th, 1921. (187,968.)
29,104. "Ignition apparatus for internal-combustion engines." F. H. Royce and Rolls-Royce, Ltd. October 25th, 1922. (205,350.)
29,613. "Electric insulators for use in connection with fuse carriers." W. Gee. October 30th, 1922. (205,355.)
31,263. "Sound records for sound-reproducing apparatus." H. Wade (Mills-Novelty Co.). November 15th, 1922. (205,366.)
32,123. "Receivers for wireless broadcasting apparatus." G. H. Champ and G. E. O. Kay. November 24th, 1922. (205,373.)
32,234. "Electric heating apparatus." G. L. Johansen. November 24th, 1922. (Convention date not granted.) (189,469.)
32,623. "Speed-regulating apparatus." Metropolitan-Vickers Electrical Co., Ltd. December 7th, 1921. (190,135.)
33,321. "Wireless aerials." T. H. Gill. December 6th, 1922. (205,389.)
33,487. "Electric contact breakers for internal-combustion engines." P. A. V. Ceresole. January 19th, 1922. (192,045.)

1923.

1,441. "Electric switch." Internationalt Radiotelegraf and Telefon Compagni ved Wahnœ & Peters. January 20th, 1922. (192,074.)
3,262. "Sound-transmitting devices for use in connection with the use of telephone receivers." M. G. Andersen. August 8th, 1922. (202,268.)
4,143. "Arrangement for preventing marginal discharge in electric fittings, more particularly in condensers." E. Pfiffner. February 11th, 1922. (193,008.)
6,459. "Make-and-break apparatus for ignition magnetos." E. W. Gauthier. March 17th, 1922. (195,058.)
9,490. "Damping device for switch contacts for electromagnetic vibrating members." A. H. Maitre and V. H. G. Martin. April 12th, 1922. (Patent of addition not granted.) (196,274.)
12,802. "Rectifying apparatus for alternating electric currents." Hewittic Electric Co., Ltd. May 15th, 1922. (197,699.)
13,618. "Vacuum tube amplifier systems and the like." Western Electric Co., Ltd. May 23rd, 1922. (198,359.)
14,355. "Adjusting apparatus for kinema reflector lamps." Ernemann Werke Akt. Ges. May 31st, 1922. (Patent of addition not granted.) (198,686.)
21,884. "Electric lighting sets for motor vehicles and the like." W. J. Nicholas and P. J. W. Roberts. May 3rd, 1922. (Divided application on 191,782.) (205,454.)